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MALAYAN AGRICULTURAL JOURNAL

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(*Continued*)

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THE MALAYAN AGRICULTURAL JOURNAL

The Journal is designed to present—as far as possible in non-technical terms—the results of the agricultural research, investigation and extension work in Malaya performed by the Department of Agriculture. Also, by means of selected articles, abstracts and reviews, this publication draws attention to the results of work of a similar nature in other countries, which have a bearing on agriculture in Malaya.

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EDITORIAL.

The Cultivation of Fodder Grasses. This issue of the Journal contains the second part of Mr. Henderson's article on the cultivation of fodder grasses in Malaya. This part of the article describes and records the results of two more experiments in which artificial fertilisers were used with a view to increasing the yields of grass.

The experiments have shown again that fodder grass yields can be increased by the application of fertilisers but that they alone are not adequate for the production of moderate yields over a period of time. Mr. Henderson emphasises the need for further experiments with artificial fertilisers and animal manures applied together to fodder grass land.

Penyakit Merah of Padi. The abnormal condition of growth known as *penyakit merah* (lit: red disease) is not usually a serious affliction of padi in Malaya but does occur in all the padi-growing areas of the country. Studies of the disease in Malaya in recent years have confirmed that it is not normally caused by any parasitic organism, and, because of this, investigations have been carried out with a view to discovering whether the disease is connected with nutrient deficiencies.

The experiment recorded in the second article in this issue was undertaken to study the effects of applications of fertilisers on the growth of padi and the uptake of nutrients by plants growing in soil from areas where *penyakit merah* had been reported.

Storage and the Viability of Padi Seed. With the development of new short term, non-photo-sensitive rice varieties, and their increasing use as an off-season crop, new and more effective methods of storing main crop seed will become essential. The usual rough and ready storage, in open sacks or as bunches of ears hung over the cooking fire, does not permit of seed being kept in a viable condition for more than a few months.

The results of an experiment undertaken by officers of the Botany Division show that cleaned and dried padi seed, kept in a sealed tin, preferably containing a drying agent, will retain its viability for a period up to two years.

The short term variety also poses another problem. To grow two or three short term crops in one year, it is necessary to reduce to a minimum the time between harvest and subsequent sowing. The minimum time within

which this can be done is governed by the length of the dormancy period, which—as Dr. Dore's paper shows—is, for many of the varieties used in Malaya, under nine weeks.

The Cost of Manufacture of China Tea. With a view to reducing the cost of manufacturing China tea at Cameron Highlands, the Agricultural Development Officer stationed there undertook experiments to introduce a mechanical tea drier.

In his short article, Mr. Kanagaratnam describes how a successful drier was constructed from an unserviceable cement mixer. The use of this drier reduced the cost of manufacture by $8 per *pikul* (133.3 lb.) of made tea and enhanced the quality of the tea produced.

ERRATA

Malayan Agricultural Journal, Vol. XXXVIII, No. 2.

Page 98, line 5:
for "out on to the" read "out of the".

Page 130, penultimate line:
for "8th March, 1955." read "8th April, 1955."

THE CULTIVATION OF FODDER GRASSES IN MALAYA.

PART II. The Application of Artificial Fertilisers.

BY

R. HENDERSON,

Acting State Agricultural Officer, Kelantan.

The existence of a large potential demand for cultivated fodder grasses in Malaya was suggested in the introductory article (2) of this series, and an experiment was described which indicated that artificial fertilisers could bring about very much larger increases in the yields of these grasses than had hitherto been thought practicable.

Two other experiments are described in the present article. These experiments were planned to explore further the possibilities of raising fodder grass yields by application of artificial fertilisers. They, also, were carried out at the Federal Experiment Station, Serdang, under the conditions described in the introductory article (2).

The first of these additional experiments was designed to provide a comprehensive assessment of the effects of inorganic nitrogen, phosphate and potash on growth and yields of Guinea grass (*Panicum maximum*). No organic manure was applied to the land throughout the course of the experiment.

EXPERIMENT No. F.E.S.S. 65.

The object was determination of the combined and separate effects of three fertilisers on yields and growth of Guinea grass.

The treatments comprised the 27 factorial combinations of absence or presence at a single or a double level of three fertilisers, supplying nitrogen, phosphate and potash respectively. Details of these treatments are reported later in this article.

The design was of the 3 x 3 x 3 factorial type. There were two complete replications of the 27 treatments, each replication comprising three randomised blocks of nine plots each. A part of the second order interaction effect was confounded with block differences.

The dimensions of the experimental area were 288 x 132 ft., and each plot measured 28 x 18 ft., surrounded by a discard strip 2 ft. wide. Until late in 1948 the area was occupied by a poor stand of old tea; this was eradicated and the land allowed to revert to natural weed fallow until August-September, 1949. At that stage, the area was mechanically cultivated and then planted at 2 x 2 ft. spacing with Guinea grass root divisions. Planting was completed by the end of September, 1949. *Lalang* (*Imperata cylindrica*) and annual weeds reappeared soon afterwards and were eradicated by hand weeding and inter-row cultivation in December, 1949, January, 1950, and subsequently whenever considered necessary.

Fertilisers were applied at quarterly intervals, and the first application was made in January, 1950. Details of the annual ingredients of the various treatments are given in Table I.

Table I. Experiment No. F.E.S.S. 65.

Quantities of Fertilisers per Acre per Year.

(cwt.)

Period	Level of Application	Sulphate of Ammonia	Superphosphate	Basic Slag (18% P_2O_5)	Muriate of Potash
Jan., 1950,	None	Nil	Nil	Nil	Nil
to	Single	2	1½	Nil	1½
Jan., 1952	Double	4	3	Nil	3
Jan., 1952	None	Nil	Nil	Nil	1½
to	Single	2	Nil	1½	3
Jan., 1953	Double	4	Nil	3	4½

Harvesting was done by sickle. All cutting was carried out in the early morning and the grass was weighed after it had been allowed to lie in the field until the dew had evaporated. Discard strips were harvested on the day preceding the cutting of recorded plot areas. The first harvest took place at the beginning of January, 1950, and was regarded as a pre-treatment cut. The first manurial application followed soon after this cut, and was followed in turn by the first experimental harvest on the 6th and 7th February, 1950. Thereafter, cutting took place at about monthly intervals until the harvest in January, 1952. Succeeding harvests were gathered at intervals of about six weeks.

The condition of the grass in all plots which did not receive muriate of potash progressively deteriorated from about mid-1950 onwards until the stools began to die out during 1951. Interim examination of yield data confirmed the suggestion that potash deficiency was the cause of the trouble, and it was decided that the levels of potash manuring should be changed from none, single and double to single, double and treble. This decision was implemented in the application made at the beginning of January, 1952, and in all subsequent applications. Vacancies in "no potash" plots were supplied and at the same time the fertiliser providing phosphate was changed to basic slag.

Yields per annum are examined in this experiment; they have been analysed separately to provide estimates of the error variances required for testing annual effects. In addition, all annual yields have been analysed together, "years" being regarded as a subdivision of treatments, to provide an estimate of the error variance required for testing effects times years interactions. Yield data are summarised in the two-way tables Tables II to IV.

Tables II, III and IV. Experiment No. F.E.S.S. 65.

Yields of Cut Grass per Experimental Year.

Table II.

7th January, 1950, to 6th January, 1951.

(12 harvests)

(tons per acre)

Manures	No Superphosphate	1½ cwt./acre Superphosphate	3 cwt./acre Superphosphate	Mean
No S.A.[1]	15.05	17.05	17.37	16.49
2 cwt./acre S.A.	21.15	17.66	20.53	19.78
4 cwt./acre S.A.	20.30	26.63	22.10	23.01
Mean	18.83	20.45	20.00	19.76
No M.P.[2]	14.69	14.98	14.28	14.65
1½ cwt./acre M.P.	20.30	19.46	23.44	21.07
3 cwt./acre M.P.	21.50	26.89	22.28	23.56
Mean	18.83	20.45	20.00	19.76

Manures	No S.A.	2 cwt./acre S.A.	4 cwt./acre S.A.	Mean
No M.P.	13.74	14.71	15.51	14.65
1½ cwt./acre M.P.	18.10	20.88	24.22	21.07
3 cwt./acre M.P.	17.63	23.75	29.29	23.56
Mean	16.49	19.78	23.01	19.76

1. S.A. = Sulphate of Ammonia.
2. M.P. = Muriate of Potash.

Standard error of any marginal mean = ± 0.9058 tons per acre.

Table III.

7th January, 1951, to 7th January, 1952.

(12 harvests)

(tons per acre)

Manures	No Superphosphate	1½ cwt./acre Superphosphate	3 cwt./acre Superphosphate	Mean
No S.A.	10.87	12.49	11.49	11.62
2 cwt./acre S.A.	13.63	12.10	15.10	13.61
4 cwt./acre S.A.	12.80	17.23	13.80	14.61
Mean	12.43	13.94	13.46	13.28
No M.P.	7.13	8.20	6.59	7.31
1½ cwt./acre M.P.	13.82	14.99	16.95	15.25
3 cwt./acre M.P.	16.35	18.64	16.85	17.28
Mean	12.43	13.94	13.46	13.28

Manures	No. S.A.	2 cwt./acre S.A.	4 cwt./acre S.A.	Mean
No M.P.	8.37	7.83	5.72	7.31
1½ cwt./acre M.P.	13.23	15.71	16.82	15.25
3 cwt./acre M.P.	13.25	17.30	21.29	17.28
Mean	11.62	13.61	14.61	13.28

Standard error of any marginal mean = ± 0.4820 tons per acre.

Table IV.

8th January, 1952, to 8th January, 1953.
(8 harvests)
(tons per acre)

Manures	No B.S.[1]	1½ cwt./acre B.S.	3 cwt./acre B.S.	Mean
No S.A.	9.90	10.58	10.39	10.29
2 cwt./acre S.A.	13.72	11.54	14.49	13.25
4 cwt./acre S.A.	13.39	15.20	13.25	13.94
Mean	12.34	12.44	12.71	12.50
1½ cwt./acre M.P.	10.89	10.00	9.90	10.27
3 cwt./acre M.P.	12.33	13.04	14.03	13.13
4½ cwt./acre M.P.	13.79	14.28	14.20	14.09
Mean	12.34	12.44	12.71	12.50

Manures	No S.A.	2 cwt./acre S.A.	4 cwt./acre S.A.	Mean
1½ cwt./acre M.P.	9.40	10.33	11.06	10.27
3 cwt./acre M.P.	10.70	14.00	14.70	13.13
4½ cwt./acre M.P.	10.77	15.42	16.07	14.09
Mean	10.29	13.25	13.94	12.50

1. B.S. = 18 per cent basic slag.
Standard error of any marginal mean = ± 0.4374 tons per acre.
Standard error for testing manurial effects x years interactions = ± 0.6703 tons per acre.

Tables V and VI summarise the effects which attained statistical significance (P equal to or less than 0.01) within and between the three years of the trial.

Table V. Experiment No. F.E.S.S. 65.

Manurial Effects which were Statistically Significant (P equal to or less than 0.01) in the Various Years of the Trial.
(tons per acre per year)

Effect	January, 1950, to January, 1951	January, 1951, to January, 1952	January, 1952, to January, 1953
N′	6.52 ± 1.2809	2.99 ± 0.6817	3.65 ± 0.6186
K′	8.90 ± 1,2809	9.97 ± 0.6817	3.82 ± 0.6186
K″	N.S.	− 5.92 ± 1.1807	N.S.
N″ P″	N.S.	− 1.09 ± 0.2783	− 0.83 ± 0.2526
N′ K′	4.94 ± 1.5688	5.34 ± 0.8349	N.S.

N′ and K′ are symbols for the linear effects of these nutrients.
N″ and K″ are symbols for the curvature effects of these nutrients.

ERRATA

Malay. agric. J., **38**, 144.

Table V.—Column 1.

1st line—K′ to read N′

3rd line—K′ to read K″

Table VI. Experiment No. F.E.S.S. 65.

Changes in Manurial Effects from Year to Year.

(with significance P equal to or less than 0.01).

(tons per acre)

Effect	Year 2 minus Year 1	Year 3 minus Year 2	S.E. Changes
N′	– 3.53	N.S.	± 0.7740
K′	N.S.	– 6.15	± 0.7740
K″	N.S.	4.00	± 1.3406
N′ K′	N.S.	– 3.52	± 0.9480

The main general conclusion from these results is that it is possible to raise the yield of Guinea grass to nearly 30 tons per acre per annum by the application of artificial fertilisers alone. The results also enable conclusions to be drawn which give a reasonably detailed and clear picture of the pattern of the yield responses to the fertilisers used. These conclusions are as follows:-

(a) sulphate of ammonia and muriate of potash both give substantial increases in yields of grass, but the phosphate fertilisers do not directly affect yields;

(b) sulphate of ammonia is uniformly effective in increasing yields of grass, over the range of application 0 to 4 cwt. per acre per annum;

(c) the yield response to muriate of potash is reduced as the application rate is raised from 1½ to 3 cwt. per acre per annum, in the second year of production;

(d) sulphate of ammonia is very much less effective in increasing grass yields in the second year of production than it is in the first. Further changes in effectiveness are unlikely in the third year of production;

(e) muriate of potash is equally effective in its capacity to raise yield levels in the first and second years of production. No conclusion can be drawn about its comparative effectiveness in the second and third years of production, since the quantities applied in the trial were changed from the second to the third year;

(f) sulphate of ammonia and muriate of potash are considerably more effective in increasing grass yields when they are both applied than when either is applied without the other. This is particularly so in the case of sulphate of ammonia, which may give rise to failure of growth if applied at the rate of 2 to 4 cwt. per acre per annum without any muriate of potash;

(g) this enhancing effect is equally effective in both the first and second years of production. No useful comparison is possible between the second and third years of production; and

(h) although phosphate does not directly affect yields of grass, it does exert a complex modifying influence on the effectiveness of sulphate of ammonia in the second and third years of production. No more specific conclusion about this appears justified from the results, but the possibilities raised by the existence of this influence are discussed in rather more detail later in the article.

Experiment No. F.E.S.S. 78.

The second experiment to be described was largely inspired by a report of the work of Holmes (3) at the farm of the Hannah Dairy Research Institute in south-west Scotland. It was suggested in the report that substantial economic improvements in yield and feeding value of grassland could be achieved by massive applications of nitrogenous fertilisers in that region.

Holmes used nitrochalk in his experiments, but sulphate of ammonia was used in the Serdang trial, partly because it was more readily available, and partly because it was felt unlikely that sulphate of ammonia would influence the acidity of Serdang soils to quite the same extent as might have been the case in Scotland.

The trial had two objects: the first was determination of the effects of sulphate of ammonia on yields and growth of Guinea grass; and the second was determination of the way in which yields of Guinea grass responded to successive applications of fertiliser, up to a much higher level than had ever been tested previously.

The treatments were as follows:-

A - No sulphate of ammonia.
B - 2 cwt. sulphate of ammonia per acre per year.
C - 4 cwt. sulphate of ammonia per acre per year.
D - 6 cwt. sulphate of ammonia per acre per year.
E - 8 cwt. sulphate of ammonia per acre per year.
F - 10 cwt. sulphate of ammonia per acre per year.

Three cutting interval sub-treatments were included in the experiment during the first 4½ months of its duration. This aspect of the trial has been described by Keeping (4) and is not dealt with in the current report. The experiment comprised six randomised blocks of six plots each. The plots were 46 x 12 ft. and were surrounded by discard strips 2 ft. wide. The site was adjacent and similar in all respects to those of Experiments F.E.S.S. 65 and 68, which have been described earlier in this paper and in the introductory article (2) in this series. The land was cultivated in October and November, 1949, and Guinea grass rooted divisions were planted at 2 x 2 ft. spacing in the latter month.

The sulphate of ammonia applications were divided into four, equal, quarterly dressings, the first of which was applied on the 30th November, 1949.

Experimental harvesting began towards the end of January, 1950, and continued until April, 1953. The cutting intervals were three, six and nine weeks until the beginning of May, 1950, when the whole area was harvested on the same date. A further complete harvest was taken six weeks later;

thereafter all the grass was cut at about monthly intervals, until the end of January, 1952. Succeeding harvests were taken at six-weekly intervals.

Determination of a suitable basal manurial mixture for the area was necessarily a matter of opinion during a considerable part of the trial. The mixture was modified from time to time, as the results of other experiments became available. Table VII gives details of the various mixtures used during the trial; they were applied in portions, at roughly three-monthly intervals.

Table VII. Experiment No. F.E.S.S. 78.

Basal Manurial Applications.

(cwt. per acre per period)

Period	Rock Phosphate	Basic Slag	Muriate of Potash
Nov., 1949, to Nov., 1950	2¼	Nil	2½
Nov., 1950, to Nov., 1951	Nil	Nil	6
Nov., 1951, to Nov., 1952	Nil	1½	5½
Nov., 1952, to April, 1953	Nil	Nil	2

Growth was generally poor in the third and fourth years, but varied noticeably in character between the treatments. Stools which did not receive sulphate of ammonia were small, stunted, erect in habit and showed widespread leaf-tip die-back. In those plots which received medium applications of 2 and 4 cwt. sulphate of ammonia, stools were taller, bigger and relatively healthy looking. At the higher levels of application, the foliage was soft, easily bent and had an unhealthy grey-brown tinge.

The figures which were statistically analysed in this experiment were those of total yields from the end of December, 1949, to the middle of April, 1953, less the yields of the harvest taken on the 1st July, 1950. These latter yields were excluded because they were harvested in the transition period between the stages of variable and uniform cutting intervals in the experiment. The total yields analysed are given in Table VIII, and illustrated in Graph I.

Table VIII. Experiment No. F.E.S.S. 78.

Total Yields of Cut Grass per Treatment.

(Period: 31st December, 1949, to 16th April, 1953, less one harvest, on 1st July, 1950)

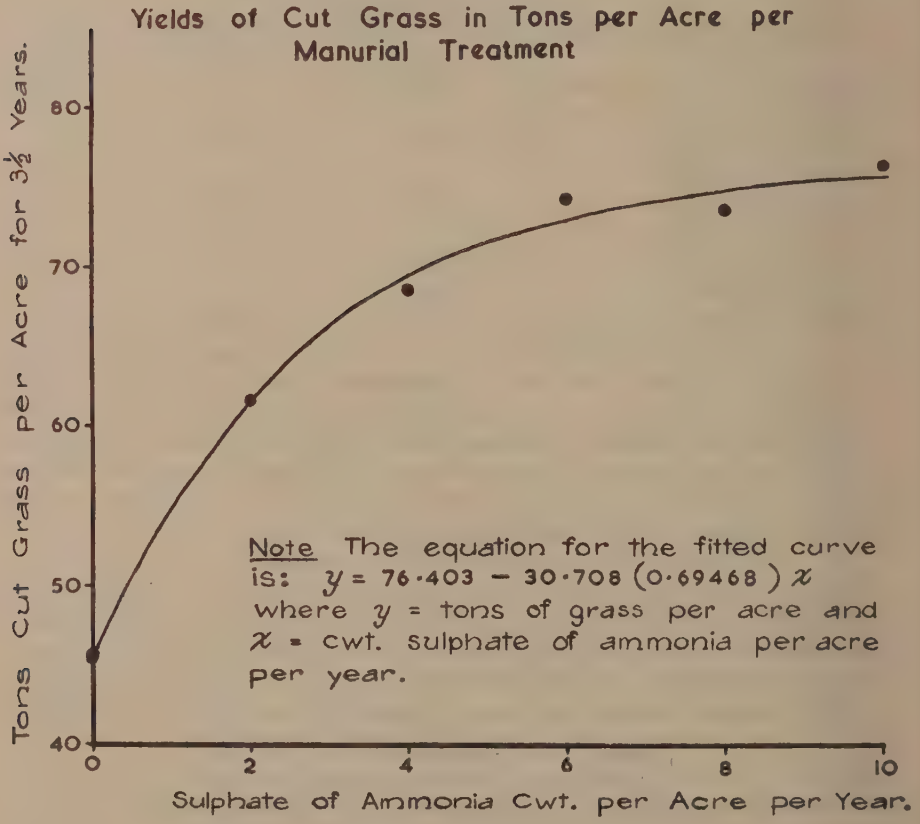
(tons per acre)

Sulphate of Ammonia per Acre per Year (cwt.)	0 (A)	2 (B)	4 (C)	6 (D)	8 (E)	10 (F)
Total Yield	45.65	61.89	68.50	74.20	73.61	76.11

Standard error = ± 2.125.

The yields are plotted against applications of sulphate of ammonia in Graph I. The curve strongly suggests that there was a consistent reduction in the yield response to successive applications of sulphate of ammonia. It was therefore decided to examine this suggestion by the method described by Stevens (5). The result of this examination was that the yield curve showed no significant deviations (P = 0.05) from the asymptotic regression curve.

Graph 1.
Experiment No. F.E.S.S. 78.


Yields of Cut Grass in Tons per Acre per Manurial Treatment
Tons Cut Grass per Acre for 3½ Years.
80
70
60
50
40
0
2
4
6
8
10
Sulphate of Ammonia Cwt. per Acre per Year.
Note The equation for the fitted curve is: y = 76·403 − 30·708 (0·69468) x where y = tons of grass per acre and x = cwt. sulphate of ammonia per acre per year.

The conclusions drawn from the results are as follows:-

(a) sulphate of ammonia can substantially increase yields of Guinea grass, and

(b) the yield response to sulphate of ammonia applications becomes progressively smaller with increase in the size of the applications.

Discussion.

The results of these experiments have demonstrated that, under conditions obtaining at the Federal Experiment Station, Serdang, yields of Guinea grass can be nearly doubled by application of artificial fertilisers. The first experiment showed that an increase of over 2 tons of fresh grass per acre per year could be obtained in the first year of production for every 1 cwt. of mixed sulphate of ammonia and muriate of potash applied, up to a limit of 7 cwt. of the mixture. This is a matter of major importance in the development of mixed farming systems in Malaya involving fodder grass, livestock and arable crops. It means that the farmer has a considerably wider range of choice in the utilisation of animal manure than was the case when it appeared that all the manure produced by livestock had to be returned to the fodder areas supporting the livestock. It also means that the carrying capacity of fodder grass areas can be considerably increased.

It is now clear, too, that the main nutrients required by fodder grasses, grown under conditions similar to those at Serdang, are nitrogen and potash. The trials suggest that phosphate is not necessary to obtain good yields at Serdang. At the same time, there is the suggestion that phosphate may well have value in promoting full expression of the yield-increasing effect of nitrogen.

The aspect of fertiliser use which is still left in doubt, in relation to fodder grass cultivation, is that of the quantitative economic limits to application rates. The results of the trials show that the effectiveness of both sulphate of ammonia and muriate of potash may be diminished as the rates of application of these fertilisers increase beyond about 4 cwt. and 1½ cwt. respectively. But these results are open to some question since, in Experiment No. F.E.S.S. 78, there is considerable doubt about the soundness of the basal dressings of other fertilisers, against which the effects of sulphate of ammonia were measured, and since, in Experiment No. F.E.S.S. 65, it was fairly clearly shown that potash was seriously deficient in the soil, so that abnormally large responses to initial applications of potassic fertilisers would be expected. Again, it has not been possible to define the economic limits to fertiliser application, by methods such as that suggested by Finney (1), because grass has no widely recognised marketable value. Finally, in this connection, it must be remembered that the effects of fertilisers have been measured in terms of yields of fresh grass. These do not necessarily parallel the effects of fertilisers on yields of nutrients, which are probably a sounder measure. On the basis of the results as they stand, however, the maximum applications which can be recommended, under conditions similar to those at Serdang, are 4 cwt. sulphate of ammonia, 3 cwt. muriate of potash and 1½ cwt. superphosphate or basic slag per acre per annum.

A point of considerable importance, emphasised by the results of Experiment No. F.E.S.S. 65, is that the effect of sulphate of ammonia is very much less in the second year of production than in the first. The yield figures for the first two years suggest, however, that this is not the only factor causing reduction in yields from the first to the second year of production. The prevention of this falling off in effect of sulphate of ammonia and the cure

of the other factor or factors causing reduction in second-year yields are clearly matters of importance in the cultivation of fodder grasses. The results of Experiment No. F.E.S.S. 68, reported in the introductory article (2) of this series, appear to have considerable significance in this connection, suggesting, as they do, that cattle manure and artificial fertilisers enhance each other's effect on grass yields to a greater extent in the second year of production than in the first.

Summary.

The experiments here described have shown, with very much greater clarity and in more detail than has previously been the case, how fodder grass yields in Malaya can be raised to higher levels by the application of fertilisers. They have also made it clear that fertilisers alone are not adequate for the production of even moderate yields over a period of years, and, in so doing, have added emphasis to the need, suggested by the results of the experiment described in the previous article (2), for exploration of the effects of fertilisers and animal manures applied together to fodder grass land.

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STUDIES ON *PENYAKIT MERAH* OF THE PADI PLANT

I. The Effect of N.P.K., Lime and Trace Elements on the Growth of Padi in Penyakit Merah Soils and the Uptake of these Nutrients in Pot Experiments.

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Introduction.

Penyakit merah, meaning red disease, has been noted in Malaya for many years, but has, apparently, varied in intensity from year to year.

Penyakit merah is present in all parts of Malaya where padi is grown. The areas most severely affected during the last two years were:- the Kuala Muda coastal area south of the Sungei Muda, Kedah; second class soils in South Krian, Perak; a small area near Lubok China, Malacca; Sungei Besar in the Tanjong Karang Scheme, Selangor; and Pasir Puteh, Kelantan.

Recent observations have shown that there are at least two distinct symptoms referred to by padi planters as *penyakit merah*. In the first, small, dark brown spots appear near the tips of the older leaves. These spots increase in size until they coalesce, and the whole leaf eventually turns dark brown and dies. In the second type, the tips of the older leaves turn yellow, and this colour progresses down the lamina leaving the mid-rib green. At this stage the symptom resembles that of phosphorus deficiency. Later, the yellow areas and the mid-rib turn orange in colour, and after half of the leaf is involved, it usually dies; the dead leaves on these plants are light brown.

The first type was noted in Malacca, Selangor and Kelantan. The second was noted in Kedah, Perak and Selangor. However, there was no sharp regional division of these symptoms and they were occasionally seen in the same field.

So far, research has failed to establish that any pathogen is responsible for the disease (3, 6 and 7) and it has consequently been attributed to "physiological causes". These have been thought to be nutritional, either due to direct shortage of some particular nutrient or to shortage brought about by poor growing conditions, e.g. stagnant water, deep water or highly reducing conditions in the soil. Moreover, the disease does not necessarily occur year after year in the same place.

A similar type of disease has been recorded in Java, under the name of "mentek" (2), and this has been attributed to potassium deficiency. In Japan, the disease "akiochi", or "autumn sickness" (1), has been attributed to excess of hydrogen sulphide due to lack of mobile iron in the soil; also,

"akagare", another similar disease, is said to be due to a shortage of potassium which is accentuated by highly reduced conditions in the soil (1). Recent investigations in the United States (5) point to excess of mobile ferrous iron as one of the causes of the disease. Mobile iron has also been suspected as a contributing factor under Malayan conditions.

Whatever the reason, the fact remains that in certain areas in certain years the disease can lead to almost total loss of crop. It may affect all the fields in a *mukim* (parish) or it may affect only one *petak* (plot). The disease may not be of great importance from the national point of view, but it is certainly serious for the individual cultivator. Another factor to be taken into consideration in the study of the disease is that the symptoms are perhaps only exhibited in the more extreme cases of deficiency and that much more widespread incipient shortage may be present even though no visual symptoms are exhibited.

Present Investigations.

From the above considerations, it was decided that a more concentrated effort should be made to elucidate some of the facets of the problem, and in the 1953-54 season a Plant Pathologist visited a large number of areas where *penyakit merah* had been reported. These areas covered many different parts of Malaya and from them he obtained quantities of soil for pot experiments with padi. At the same time, soil was taken from adjacent areas where *penyakit merah* was not apparent. , All these soil samples were used to set up the pot experiments in which various manurial treatments were tried out. The plants were harvested at the flowering stage and the dry weight determined. The N, P, K, Ca and Mg contents of the plants were then determined. The method of using dry weights to determine nutrient effect has been used by Webb (8) in the Gambia, but we have introduced plant analyses in order to study further the uptake of the nutrients.

Experiment Details.

Soils were obtained from the following areas:-

Kedah:	Kepala Batas, Salak Kanan, Kampong Langgar, Rantau Panjang.
Penang:	Kampong Terang, Sungei Rusa.
Perak:	Sungei Dungun (Krian).
Kelantan	Kampong Pusu, Pasir Puteh, Bendang Jenerek, Tumpat, Bangol Pa Esah, Bendang Pa Durian.
Malacca:	Alor Gajah, Pulau Gadong.

They were air dried and fertilisers added at the following rates:- sulphate of ammonia 336 lb./acre; single superphosphate 448 lb./acre; muriate of potash 200 lb./acre. Lime, where added, was given to bring the pH up to 5.0 after calculating the lime requirement.

The lime, superphosphate and half the muriate of potash dressings were thoroughly mixed with the soil, which was then wetted and allowed to stand for some days before planting the padi seedlings (variety: Bemban, a variety known to be very susceptible to *penyakit merah*). The sulphate of

ammonia and the balance of the potash were added in solution three weeks after planting. Trace elements were sprayed on six weeks after planting. Pots, 7½ in. in diameter and holding 1 kilo. of soil, were used, and the seedlings were planted out three to a pot, the pots being placed in trays just sufficiently deep for the water to come up to the top of them. The trays were placed in large tanks through which there was a gradual movement of water.

There were not sufficient soil samples for all the treatments, so seven were left out (see Tables).

With the few exceptions indicated in Table I, all treatments were duplicated.

Treatments were as follows:-

A. Diseased soil without treatment.
B. Complete treatment (N.P.K., Lime and Trace Elements).
C. ,, ,, minus Lime.
D. ,, ,, minus Trace Elements.
E. ,, ,, minus Potassium.
F. ,, ,, minus Phosphorus.
G. ,, ,, minus Nitrogen.
H. Healthy soil without treatment.
I. ,, ,, with complete treatment (N.P.K. plus Lime plus Trace Element).

In all, the experiment involved 255 pots and 1,124 leaf analyses. When the plants were harvested the total weight for each pot was recorded and samples taken for determination of dry matter and, afterwards, for ashing and determination of nutrients. The weights of harvested material are recorded in Table I.

Experiment Results.

Plant Weights.

The plants in some of the pots were severely damaged by stem borer attack so that duplicates had widely differing weights; this is the reason for some of the discrepancies in the table. Nevertheless, the response to phosphorus is very marked and none of the other elements appears to have had much effect except possibly nitrogen, the lack of which, as was to be expected, decreased vegetative growth slightly. Phosphorus had a most marked effect on the soils from Kampong Langgar, Kedah, which, strangely enough, come from what is normally regarded for Malaya as a high-yielding district, and also on those from Rantau Panjang. Phosphorus had also a very marked effect on the soils from Kampong Pusu, Pasir Mas, Kelantan, an area suspected to be very deficient in phosphorus.

The dolomitic limestone, which could act either by increasing the pH or from the magnesium it contains, showed no beneficial effects. The application of trace elements, even in Treatment B, did not show any advantage.

The average number of tillers produced per pot for each of the treatments is given in the last line of Table I. There is to be noted a very

Table I.

Weight (gm) of Green Material Produced by each Treatment. (average of two pots)

Locality	Diseased Soil						Healthy Soil		Average	Increase for P treatment. (Average of treatments with P - Average of treatments without P)
	No. Treatment	Complete Treatment (N.P.K., Lime and Trace Elements)						No. Treatment		
	—	All	Less lime	Less trace element	Less K	Less P	Less N	All	—		
	A	B	C	D	E	F	G	H	I		
KEDAH.											
Kepala Batas	41	64	81	32	59	104	62	—	—	63.3	– 12.9
Salak Kanan	37	108	84	83	100	68	46	66*	110*	78.0	+ 31.7
Kampong Langgar	20	242	278	268	279	57	341	199	74	195.3	+243.1
Rantau Panjang	25	80	116	105	101	57	68	84	158	88.2	+ 53.0
PENANG.											
Sungei Rusa	50	73	90	77	52	63	54	—	—	65.6	+ 12.7
Kampong Terang	27	111	94	68	96	55	89	36*	151*	80.7	+ 50.6
PERAK.											
Sungei Dungun, Krian	15	—	76	100	113	55	62	25	74	65.0	+ 52.7
KELANTAN.											
Kg. Pusu (W)	44	191	138	157	151	22	121	—	—	117.7	+118.6
Pasir Puteh	97	101	139	149	133	81	98	84*	71*	105.9	+ 35.0
Bendang Jenereh	48	—	115	108	96	52	90	91*	154*	94.2	+ 52.3
Kg. Pusu (D)	12	69	65	52	51	9*	31	50*	122*	51.2	+ 43.1
Tumpat	46	107	119	160	165	77	109	81*	38*	100.2	+ 70.5
Bangol Pa Esah	29	73	47	76	56	43	46	53*	31*	50.4	+ 23.6
Bendang Pa Durian	13	50	94	125	90	10	66	101*	38*	65.2	+ 73.5
MALACCA.											
Alor Gajah	37	38	69	74	89	54	47	64	119	65.6	+ 17.9
Pulau Gadong	39	193	105	114	160	90	165	63*	134*	118.1	+ 82.9
Average for treatments	36.2	107.1	106.9	109.2	111.9	56.0	93.5	76.7	98.0		
Average No. of tillers produced in each treatment	6.5	12.1	14.2	15.1	14.6	5.4	14.4	6.3	10.9		

* = based on one pot. (W) = area where wet padi is grown. (D) = area where dry padi is grown.

marked effect on the number of tillers by phosphorus; none of the other treatments shows any similar effect.

Effect of treatments on the visual appearance of the plants indicated that Treatments C and E were the best since symptoms of P and N deficiency did not appear on these plants until the later stages. The rest of the plants on 'diseased' soil showed these deficiency symptoms from an early stage. The plants on 'diseased' soil were generally in a poor condition and all symptoms could not be classified. The orange type of *penyakit merah* appeared on most of these plants. The brown-leaved type was not known at that time, consequently no attempt was made to correlate it with origin of soil.

Leaf Symptoms.

Before the plants had stopped tillering, it was noticed that some of them were very small and weakly rooted. At harvest, these plants showed an interveinal chlorosis that appeared to be caused by Ca. deficiency, though Mg. deficiency is similar in appearance to Ca. deficiency in the early stages (4). For some unknown reason the plants involved were those in Treatments A and F—both having no P. The severity of the symptoms varied according to the origin of the soil; soil from Kampong Pusu seemed to be worst.

Analyses of the Plants.

After the plants were harvested, samples were taken for determination of moisture and for chemical analyses. The average moisture content was 68.96 per cent, with a maximum of 74.29 and a minimum of 64.32 per cent. The samples were dry ashed by the usual method, i.e. slowly heating to 300°C and thereafter to 500°C until a white ash was obtained. The percentage ash on dry matter basis was recorded and after extraction with concentrated hydrochloric acid the extract was analysed for P_2O_5, K_2O, CaO and MgO.

P_2O_5 was determined by the molybdenum blue method, K_2O in the flame photometer, CaO by the oxalate method and MgO by precipitation as phosphate.

The results were recorded as percentage nutrient on ash. In Tables II, III, IV and V, the results for the nutrients are set out to show the influence of the treatments on their uptake by the plant.

Two factors emerge from Table II; one is the very great increase in the uptake of phosphorus with phosphorus dressings, and the other is the generally low values for the reputedly healthy soils. It will be seen from Tables III, IV and V that the manurial treatments have little effect on the uptake of nutrients other than phosphorus, and it would appear that the interaction is negligible. It is thus possible to discuss the increase in yields given in the last column of Table I in relation to Table II.

A conflicting result is that for Kepala Batas. P in the control is low, there is a great increase in uptake of phosphorus, yet there is actually a slight decrease in the yield with manuring. The three soils with high P in the controls, i.e. Salak Kanan, Sungei Rusa and Alor Gajah, also show the lowest percentage increases for P treatment, i.e. 60, 22 and 37 per cent (calculated as the percentage of the average of Treatments B, C, D, E and

G over the average for Treatments A and F). Those with the lowest P in the control, e.g. Kg. Langgar and Bendang Pa Durian, show six-fold increases in yield with P treatment. There is little doubt, from a consideration of the foregoing points, of a very marked P effect.

Table II.

Effect of Several Manurial Treatments on the Uptake of P_2O_5 by Padi on Soils from Different Areas.

(expressed as percentage ash)

	Diseased Soil							Healthy Soil	
	No Treatment	Complete Treatment (N.P.K., Lime and Trace Elements)						No Treatment	
Locality	—	All	Less lime	Less trace elements	Less K	Less P	Less N	All	—
	A	B	C	D	E	F	G	H	I
KEDAH.									
Kepala Batas	1.01	3.15	3.71	3.54	3.98	1.08	4.64	—	—
Sala Kanan	2.03	3.03	3.23	3.08	3.14	1.84	2.58	2.71	2.88
Kg. Langgar	0.56	2.14	1.58	2.29	2.21	0.97	2.61	3.24	3.76
Rantau Panjang	1.31	3.09	3.09	2.49	3.23	0.84	3.10	0.86	2.80
PENANG.									
Sungei Rusa	2.82	2.49	3.03	2.33	3.19	2.80	2.73	—	—
Kg. Terang	0.92	3.65	4.32	3.95	4.01	1.01	5.61	1.51	3.47
PERAK.									
Sg. Dungun, Krian	0.62	—	3.82	3.38	3.05	0.76	3.27	1.17	3.14
KELANTAN.									
Kg. Pusu (W)	0.99	2.92	2.86	2.69	3.65	0.83	4.40	—	—
Pasir Puteh	1.34	2.61	3.01	2.88	2.95	1.35	3.52	0.75	4.19
Bendang Jenereh	1.66	—	2.89	2.84	2.63	1.87	3.11	—	3.89
Kg. Pusu (D)	0.92	2.99	4.05	3.82	3.78	0.91	4.50	1.42	2.83
Tumpat	0.97	3.72	3.44	3.30	4.14	1.39	3.84	1.15	3.67
Bangol Pa Esah	0.96	2.99	3.52	3.57	3.35	0.97	3.54	1.45	2.43
Bendang Pa Durian	0.61	2.81	2.61	2.98	2.62	0.79	2.65	1.38	3.44
MALACCA.									
Alor Gajah	1.97	3.33	3.57	3.88	2.60	2.45	3.59	1.33	3.31
Pulau Gadong	1.03	3.60	3.77	3.06	3.56	0.92	3.71	1.14	3.51
Average for treatments	1.25	3.03	3.28	3.12	3.26	1.30	3.59	1.51	3.33

The differences between the non-P and P treatments are distorted because of the small pots. Because of these, the roots did not have as much soil to explore as they would have done under normal circumstances. On the

other hand, the results for Salak Kanan and Sungei Rusa show that even in soils with high P values the plant can still take up considerable quantities of phosphate when a dressing of P is added.

Table III.

Effect of Various Manurial Treatments on the Uptake of K_2O by Padi on Soils from Several Areas.

(expressed as percentage ash)

Locality	Diseased Soil							Healthy Soil	
	No Treatment	Complete Treatment (N.P.K., Lime and Trace Elements)							No Treatment
	—	All	Less lime	Less trace elements	Less K	Less P	Less N	All	—
	A	B	C	D	E	F	G	H	I
KEDAH.									
Kepala Batas	13.95	17.84	17.74	15.77	17.53	19.70	18.03	—	—
Sala Kanan	14.18	17.55	18.47	16.92	18.19	17.68	13.35	18.25	17.99
Kg. Langgar	15.79	18.65	21.27	20.49	19.75	24.17	19.66	18.79	17.71
Rantau Panjang	14.80	16.79	17.75	16.28	17.63	16.30	17.23	18.00	17.59
PENANG.									
Sungei Rusa	15.51	16.92	17.53	15.17	16.27	17.68	15.78	—	—
Kg. Terang	17.71	20.28	20.05	17.76	18.59	21.18	22.73	21.64	19.83
PERAK.									
Sg. Dungun, Krian	18.13	—	19.32	19.08	19.09	21.00	18.39	19.06	19.92
KELANTAN.									
Kg. Pusu (W)	23.99	20.39	20.12	20.18	21.72	24.80	21.06	—	—
Pasir Puteh	14.88	15.62	17.31	19.04	16.90	19.90	17.47	16.35	21.03
Bendang Jenereh	15.34	—	17.85	18.74	17.03	19.66	17.13	—	21.40
Kg. Pusu (D)	23.87	19.70	20.79	20.65	19.30	27.64	21.17	25.40	22.33
Tumpat	18.43	19.35	18.97	18.73	18.41	19.74	18.46	20.80	20.68
Bangol Pa Esah	15.60	18.69	16.07	16.99	18.40	17.40	17.29	17.17	14.53
Bendang Pa Durian	16.62	18.68	17.00	17.65	17.80	18.36	18.08	18.18	18.07
MALACCA.									
Alor Gajah	15.65	16.81	19.97	20.01	18.48	19.06	19.48	18.16	19.56
Pulau Gadong	18.73	22.22	21.37	18.36	21.04	19.25	19.38	19.60	20.59
Average for treatments	17.07	18.53	18.85	18.30	18.51	20.21	18.42	19.28	17.94

Table III shows quite a considerable variation in the value for K in the plants, the more surprising results being the high K values for Kg. Pusu soils which are regarded as rather poor. The controls are generally slightly

lower than the treated pots even in the minus K series, but this is probably due to the stimulus to growth provided by the other nutrients.

Table IV.

Effect of Various Manurial Treatments on the Uptake of MgO by Padi on Soils from Different Areas.

(expressed as percentage ash)

Locality	Diseased Soil							Healthy Soil	
	No Treatment	Complete Treatment (N.P.K., Lime and Trace Elements)							No Treatment
	—	All	Less lime	Less trace elements	Less K	Less P	Less N	All	—
	A	B	C	D	E	F	G	H	I
KEDAH.									
Kepala Batas	1.01	1.08	1.15	1.45	1.70	1.19	2.13	—	—
Sala Kanan	1.31	1.28	1.37	1.26	1.47	1.07	1.46	1.48	1.44
Kg. Langgar	0.54	1.04	0.64	1.34	1.67	2.00	2.05	1.31	1.50
Rantau Panjang	1.44	1.82	1.41	1.40	1.83	1.66	2.23	1.54	1.63
PENANG.									
Sungei Rusa	1.75	1.52	1.28	1.21	1.75	1.73	1.60	—	—
Kg. Terang	0.82	1.18	1.39	1.43	1.82	0.75	2.58	0.87	1.57
PERAK.									
Sg. Dungun, Krian	0.93	—	1.98	1.52	1.51	1.32	2.06	1.12	1.52
KELANTAN.									
Kg. Pusu (W)	1.42	1.42	1.21	1.45	1.86	1.73	2.65	—	—
Pasir Puteh	0.66	1.22	0.95	1.31	1.39	1.47	1.94	0.94	1.44
Bendang Jenereh	0.96	—	1.24	1.36	1.50	1.23	2.18	—	1.55
Kg. Pusu (D)	1.25	1.66	1.37	1.91	1.79	2.03	2.42	1.98	1.55
Tumpat	0.87	1.55	1.01	1.47	1.59	1.49	2.15	0.93	1.22
Bangol Pa Esah	1.07	1.44	1.54	1.64	1.65	1.46	2.00	1.19	1.28
Bendang Pa Durian	0.85	1.26	1.04	1.38	1.43	1.20	1.62	1.01	1.29
MALACCA.									
Alor Gajah	0.72	1.67	1.19	1.45	1.38	1.49	1.86	1.11	1.56
Pulau Gadong	0.49	1.42	0.98	1.21	1.61	1.23	1.53	0.98	1.43
Average for treatments	1.01	1.39	1.23	1.42	1.62	1.43	2.03	1.22	1.46

Although no magnesium was applied as such, the lime was dolomitic limestone containing 15 per cent MgO. Thus any pots which were limed received a comparatively heavy dressing of MgO. Table IV shows that all treatments increase the uptake of magnesium and the greatest increase is

in the pots without nitrogen. The treatment minus lime, and therefore minus Mg, is lowest after the control, so that the treatment would appear to have increased uptake to some extent. It had no effect on yield however.

Graph I illustrates the data shown in Tables I to IV. The effects are the average of the individual effects of each treatment on all the soils, i.e. the last row of each table. This graph illustrates how closely P_2O_5 in the leaves is correlated with weight of plants.

Table V.

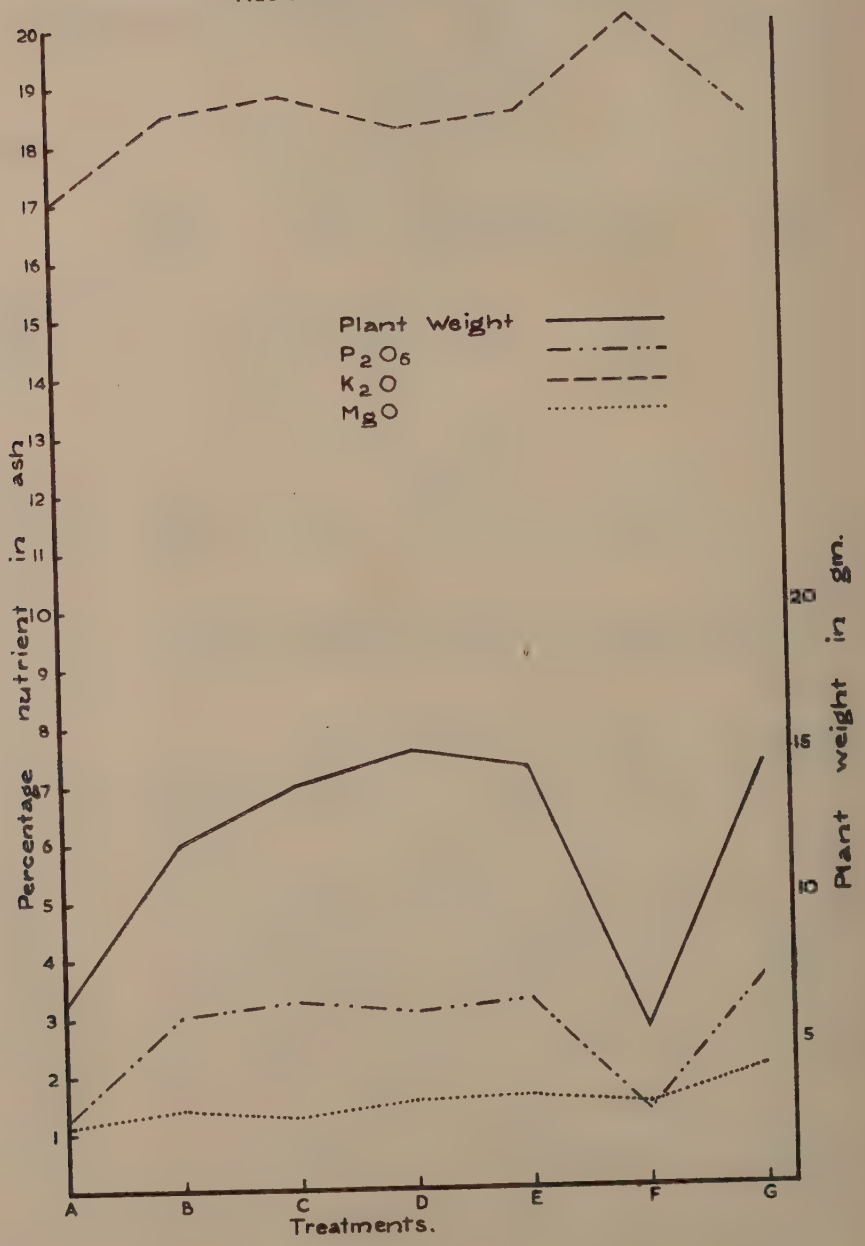
Effect of Various Manurial Treatments on the Uptake of CaO by Padi on Soils from Different Areas.

(expressed as percentage ash)

Locality	Diseased Soil							Healthy Soil	
	No Treatment	Complete Treatment (N.P.K., Lime and Trace Elements)						No Treatment	
	—	All	Less lime	Less trace elements	Less K	Less P	Less N	All	—
	A	B	C	D	E	F	G	H	I
KEDAH.									
Kepala Batas	5.23	3.69	4.43	4.90	4.25	4.38	4.72	—	—
Sala Kanan	3.25	3.45	3.67	3.60	3.26	3.24	2.46	3.16	3.31
Kg. Langgar	4.38	3.74	3.99	3.72	4.14	4.71	5.74	4.13	4.67
Rantau Panjang	4.02	4.96	3.62	4.08	4.09	3.94	5.20	3.70	4.42
PENANG.									
Sungei Rusa	4.18	3.60	3.87	4.97	3.96	3.63	4.16	—	—
Kg. Terang	5.34	4.62	5.28	4.30	4.38	4.55	5.36	4.27	4.92
PERAK.									
Sg. Dungun, Krian	4.72	—	5.53	3.90	3.52	4.05	4.23	3.76	3.58
KELANTAN.									
Kg. Pusu (W)	4.68	4.84	4.30	4.31	4.31	4.20	6.10	—	—
Pasir Puteh	4.44	4.33	4.47	4.29	4.08	4.26	5.58	4.05	3.51
Bendang Jenereh	4.80	—	4.69	4.48	4.85	4.00	5.18	—	4.74
Kg. Pusu (D)	4.04	5.07	5.27	4.72	4.75	4.38	4.42	4.50	4.74
Tumpat	4.11	4.61	4.30	4.20	4.38	4.47	5.44	3.84	4.55
Bangol Pa Esah	3.86	3.85	4.59	4.44	4.06	3.72	4.78	4.69	5.81
Bendang Pa Durian	2.92	3.66	3.79	3.61	3.32	2.76	3.68	3.16	3.47
MALACCA.									
Alor Gajah	4.46	4.42	5.20	3.78	3.68	3.96	4.66	4.71	4.23
Pulau Gadong	4.50	3.80	3.99	4.30	3.97	3.95	5.14	5.11	4.43
Average for treatments	4.31	4.19	4.44	4.22	4.06	4.01	4.80	4.09	4.34

Graph I

Showing Variation of Weight & Uptake of Nutrients with Treatment.



Calcium, like magnesium, shows a considerable variation from treatment to treatment but there is no regular pattern (Table V), and when the average for each treatment is taken it will be seen that the fertilisers have had no influence on the uptake of calcium.

Discussion.

This experiment was set up to study the effects of relatively heavy dressings of fertilisers on the growth of and uptake of nutrients by padi planted in soils where *penyakit merah* was likely to occur.

The results show that, under the conditions and limitations of a pot experiment, phosphorus produces a very marked effect on the growth of the padi and on the uptake of this element by the plants. The point to consider is how this information can be used to interpret the occurrence of *penyakit merah*. Field work to date has indicated that in certain circumstances phosphates have had a curative effect on the disease, but on other occasions they have had no effect whatever.

Investigations have also shown that there are several conditions which go by the name of *penyakit merah*, and that the symptoms in each of these differ to such an extent that there is every likelihood that several causes may be found. *Penyakit merah* seems to be found most commonly when growing conditions are adverse. Thus, very poor off-season drainage and stagnant water conditions during the period of active growth seem to accentuate occurrences of the disease. If some forms of the disease are brought about by phosphate deficiency, it may not be an absolute deficiency, but rather that the phosphate in the soil is near the threshhold value. When growing conditions are ideal the plant obtains just enough phosphorus for its needs and hence does not show stunted growth. When, however, growing conditions are adverse, as, for example, when there is excess free ferrous iron due to severe reducing conditions, insufficient phosphorus is available for the plant which then shows deficiency symptoms. By the time the symptoms appear it may be too late to cure the disease by the application of phosphorus.

Another point is that examination of the tables shows that the padi on the so-called healthy soils has benefited considerably both in P uptake and growth from P applications. This again raises the question of threshhold values, for even the soils which do not show symptoms of the disease benefit from phosphorus applications.

Summary.

The effect of N, P, K, Mg, lime and trace elements was examined in a series of pot experiments using soils from places where *penyakit merah* was of common occurrence. The effect of these treatments on the weight of plants produced and on the uptake of P, K, Ca and Mg has been studied. Phosphorus had a very marked effect both on weight of plant and on the uptake of this element by the plant.

Acknowledgements.

The authors wish to acknowledge the part played by Dr. W. J. Cherewick, formerly Plant Pathologist in the Department of Agriculture

under the Colombo Plan. He was responsible for selecting the soil samples and for laying out and starting the experiment. When he left, the experiment was supervised by officers of the Plant Pathology Division under Mr. A. Johnston, to whom thanks are also due.

Finally, we wish to acknowledge the help and interest of Mr. R. B. Jagoe, Chief Research Officer in the Department, who has taken a great interest in the problem of *penyakit merah* for many years, and on whose suggestion this investigation was initiated by Dr. Cherewick.

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DORMANCY AND VIABILITY OF PADI SEED

BY

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Introduction.

The dormancy of padi seed in tropical climates has been studied by workers in Ceylon (2) and India (7 and 10) where a distinct relationship was found between the period of dormancy and the photoperiod.

No study made in Malaya relates dormancy to photosensitivity, although Burgess (1) carried out germination tests on freshly harvested padi.

Several workers (5, 12, 4 and 3) have studied the storage conditions of plant seed in the tropics, but the writer has found no data on the storage of padi for seed, although much work has been carried out on the storage of padi for food (vide 6).

This paper examines the results of weekly germination tests of padi varieties from areas in the north and south of the Federation of Malaya and compares the dormancy period with maturation period (sowing to harvest), which is a partial function of the photosensitivity of the plant. It also incorporates data obtained on the viability of padi seed stored under different conditions.

Duration of Dormancy of Freshly Harvested Padi.

It is of considerable importance in areas of Malaya where an off-season crop of padi is planted to know the time lapse occuring between the harvesting of the ripe grain and its attainment of 99 to 100 per cent germinability. Burgess (1) had this in mind when he examined the increase in germinability of freshly harvested Mayang Ebos 208 (a variety no longer in use) from the Krian irrigation area. It was decided to repeat this work to determine the dormant period of a number of common varieties, and to ascertain the effect of different storage conditions on the rate of decrease of dormancy. It is also of importance to know if the dormant period is related to the varietal photosensitivity, since in Ceylon and India it has been shown that long term varieties remain dormant for a greater time than do short and medium term varieties.

The advantages to planters of second-crop seed with a short dormancy period is obvious where double cropping is practiced since the time between harvesting and second sowing can be reduced to a minimum.

Methods.

Freshly harvested grain of 21 varieties was obtained from padi stations in Krian and Malacca (Table I). Each lot of grain was divided into two portions and stored in paper bags either in a laboratory cupboard or in an

air-conditioned room. The details of these environments are given in connection with the storage experiments described below. One hundred seeds from each lot were taken at weekly intervals from the date of harvest and planted on moist filter paper in petri-dishes. The petri-dishes were maintained in the dark at room temperature [about 80°F (27°C)] and counts of germinated seed were made after 10 days.

Results.

Length of Dormant Period.

The mean weekly germination percentages for the varieties tested are shown in Table I. The percentages shown are the means from seeds stored in the laboratory and in the air-conditioned room.

The maturation period at the place of origin is given in the final column of Table I. These maturation periods are the mean maturation period obtained over five to six years at the padi stations from which the samples of seed were obtained. They are in some cases longer than the maturation periods found in normal planting practice.

The place of origin of the sample has been designated by the area in the Federation from which the sample was obtained; the southern area lies below lat. 2°N, and north-central between 5°N and 6°N.

Examination of the results shows that there is no relation between maturation period and dormancy time (number of weeks to attain 98 per cent germination or more). The only non-photosensitive variety included among the test varieties is Pebifun, a *Japonica* variety, and this shows a dormancy period of five weeks. Most of the remaining photosensitive varieties behave in a similar way, and reach 98 per cent germination in between seven and 11 weeks, with a mean dormancy period of 8.6 weeks. Thus the varieties examined fall within the first of Chandraratna's (2) groups, which included those rice varieties showing a dormancy period of eight weeks. Only Mayang Ebos 80 among the varieties studied falls in Chandraratna's second group of varieties, which has a dormancy period of 14 to 16 weeks. Malayan varieties, are, in general, much longer maturing than those used in Ceylon, yet Malayan varieties with these long maturation periods have a shorter dormancy period than Ceylon varieties of similar maturation period. The Malayan varieties fall in the eight-week dormancy group, whilst the comparable Ceylonese varieties fall in the 14- to 16-week dormancy group.

Of greatest interest in these results is the rate of increase in germination before the attainment of maximum germination. Considerable variation is shown in the curves for increasing germination. Nine varieties [Anak Naga, Radin China 4, Acheh Puteh, Mas, Milek Kuning, Antah Beras, Seriap, Siam 29 (from the north-central region only) and Nachin 11 (from north-central only)] attain 50 per cent or more germination in under three weeks, whilst the remaining varieties attain 50 per cent or more germination in from four to six weeks.

Table II compares the maturation period with the time to attain 50 per cent germination. Since a batch of seed showing more than 50 per cent germination can be considered to be just sufficiently viable for use

Table I.

Percentage Germination.

Padi Variety	Place of Origin	Date of Harvest	Number of Weeks from Harvest													Mean Maturation Period
		1954	1	2	3	4	5	6	7	8	9	10	11	12	13	Days
Rambutan	South (Malacca)	18 III	3	10.5	14.5	36	47	63	80	88.5	98	99	99	—	—	264
Radin Merah	„	18 III	15.5	23.5	41	61.5	72	91.5	94	98	99	—	—	—	—	256
Anak Naga	„	22 II	4	25	56.5	84	95	97	99.5	—	—	—	—	—	—	246
Acheh Puteh	„	28 II	11.5	30	54.5	80.5	93	93	97	98.5	98.5	—	—	—	—	228
Milek Kuning	„	7 III	59.5	84.5	84.5	93.5	96	99.5	98.5	—	—	—	—	—	—	226
Radin China 4	„	28 II	19.5	29	54	86.5	94	96	97	97.5	99	—	—	—	—	225
Nachin 11	„	26 I	0.5	1.5	5	21	42	68	87	94.5	97.5	99	—	—	—	215
Mayang Ebos 88	„	28 II	4	7.5	17.5	59.5	74.5	79.5	91.5	97	98.5	98	100	—	—	213
Antah Beras	„	16 III	63.5	75	89	94	97.5	100	—	—	—	—	—	—	—	211
Mayang Ebos 80	„	16 II	—	—	1	9.5	21.5	72	81	84	89.5	88.5	94	93.5	98	209
Siam 29	„	26 I	1	6	12	41.5	55	82.5	94.5	98	99	98.5	—	—	—	209
Reyong 6	„	26 I	1	5	5	18	39	62.5	84	95.5	98.5	98.5	—	—	—	197
Seriap	„	28 III	41.5	48	57.5	79	85	88	98	87.5	97.5	98.5	—	—	—	184
Radin Siak 34	„	26 I	1.5	4.5	14.5	48.5	62	78	95.5	96.5	99	99	—	—	—	172
Mas	„	3 III	13	33	55.5	71	85	96	98.5	99	—	—	—	—	—	165
Mayang Sa Gumpal	North-Central (Krian)	15 II	2	0.5	6	26	57.5	83.5	90.5	97	97	100	—	—	—	225
Seraup Kechil 48	„	15 II	0.5	4	12	24.5	50.5	69.5	82	87.5	96	92.5	99	—	—	220
Seri Raja	„	15 II	4.5	8	28	53.5	68.5	87	92	96	99.5	—	—	—	—	216
Mayang Sa Batil 8	„	15 II	0.5	2	6.5	37	67.5	76.5	87.5	92	97.5	99	—	—	—	209
Reyong 6	„	5 II	4.5	9.5	17.5	33	38.5	74	80.5	94	96.5	99	99	—	—	207
Arong	„	15 II	4.5	11.5	29.5	56	70.5	76	92.5	96	98	98.5	99.5	—	—	204
Nachin 11	„	14 III	96.5	98	98.5	—	—	—	—	—	—	—	—	—	—	195
Siam 29	„	14 III	70	87.5	93	94.5	98	98	—	—	—	—	—	—	—	193
Radin Siak 34	„	8 II	7	10	26	53.5	74.5	83.5	91	95.5	95	98	100	—	—	179
Pebifun	„	19 III	83.5	89	91.5	94	99.5	98	—	—	—	—	—	—	—	Not available

in the field in an emergency, this period of time is probably the minimum time from harvest in which a succeeding off-season crop can be economically planted. Although not statistically significant, the mean maturation periods of varieties with different durations to 50 per cent dormancy show the existence of a possible trend. The earlier maturing varieties tend to have a more rapid maturation of the seed than the slightly longer term varieties. Further work is needed before the validity of this can be fully proved.

Table II.

Maturation Period of Padi Varieties Attaining

50 Per Cent Germination in One to Six Weeks.

	Weeks					
	1	2	3	4	5	6
No. of Varieties	4	0	5	5	5	5
Maturation period of varieties in days	226	–	246	213	209	197
	211	–	225	256	172	215
	193	–	228	179	220	209
	195	–	165	216	209	264
	–	–	184	204	225	207
Mean maturation period	206.3	–	209.6	213.6	207.0	216.4

Effect of Method of Storage on Dormancy.

The results given in Table I are the average of germination percentages from seed stored in the laboratory or in an air-conditioned room. The individual results for each storage condition have been examined and, for Reyong 6, Seraup Kechil 48, Seri Raja, Mayang Sa Batil, Mayang Sa Gumpal, Anak Naga, Radin China 4, Mayang Ebos 80, Mas, Milek Kuning, Siam 29 (from the north-central region), Nachin 11, Antah Beras, Radin Merah, Rambutan, Pebifun and Seriap, no differences due to storage conditions are found between the rates of attainment of maximum germination or the lengths of the dormancy period.

For the remaining varieties in these tests, no differences were found in the total dormancy period of seed stored in the laboratory or in an air-conditioned room, but differences in the time to reach intermediate germination percentages were found. The rate of loss of dormancy thus varied with the storage condition.

The varieties showing differences are listed in Table III, which contains only samples obtained from the southern region, and this Table illustrates that although neither storage condition causes a delay in the time to

reach maximum percentage germination, a higher percentage germination is reached earlier in laboratory stored seeds than in air-conditioned room stored seeds. It is presumed that the lower temperature and more uniform relative humidity of the seeds stored in the air-conditioned room delays the rate of dormancy reduction of seeds for a few weeks, but that this delay is not permanent, nor does it affect all samples. The 80 per cent germination level was chosen to illustrate this because Chandraratna (2) used this level as measure of a reasonably useful germinability for planting purposes.

Table III.

Time in Weeks to Reach 80 Per Cent or More Germination.

Padi Variety	Stored in Air-conditioned Room	Stored in Laboratory
Siam 29	7	6
Radin Siak 34	7	6
Nachin 11	8	6
Mayang Ebos 88	7	5
Acheh Puteh	5	4

Two samples from the north-central region, Radin Siak 34 and Arong, showed delays in early stages of after-ripening. Radin Siak 34 seed reached 70 per cent germination in six weeks when stored in the air-conditioned room, and in five weeks when stored in the laboratory, whilst Arong only showed a delay between the two storage conditions in the first few weeks, reaching 60 per cent germination in four weeks for laboratory stored seed, and in five weeks for seed stored in the air-conditioned room.

The difference found can be seen in Figure I, which shows four sets of curves of the seven samples showing differences in germination due to storage. These differences show quite clearly, and can be compared with the set of curves in Figure II, which show samples with no such differences.

Decrease of Viability of Stored Padi.

A large number of investigations has been made into the maintenance of viability in stored seed. Porter (8) has reviewed the factors affecting loss of seed viability in storage, and the most important of these factors under Malayan conditions are the high relative humidity and temperature, both of which cause rapid loss in vitality of the seed. A four-year experiment to test storage conditions under different temperature and humidity conditions was commenced in the Botanical Division in 1952.

Methods.

Seed samples of six padi varieties, from the 1952 harvest, were each divided into three lots, and stored under three different conditions—namely, in the laboratory in paper bags or in sealed bottles with anhydrous calcium chloride, or in an air-conditioned room. The air-conditioned room had an

Figure 1.
Effect of storage condition on padi dormancy. (1) Varieties showing differences.

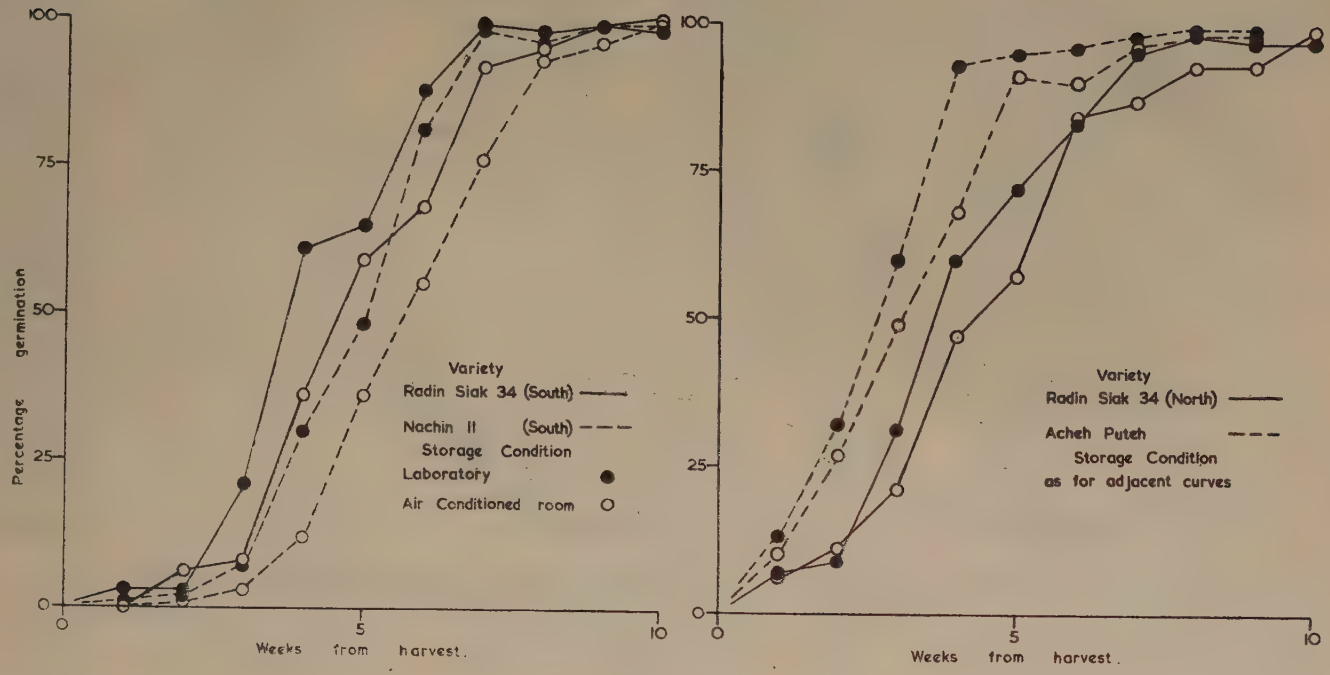
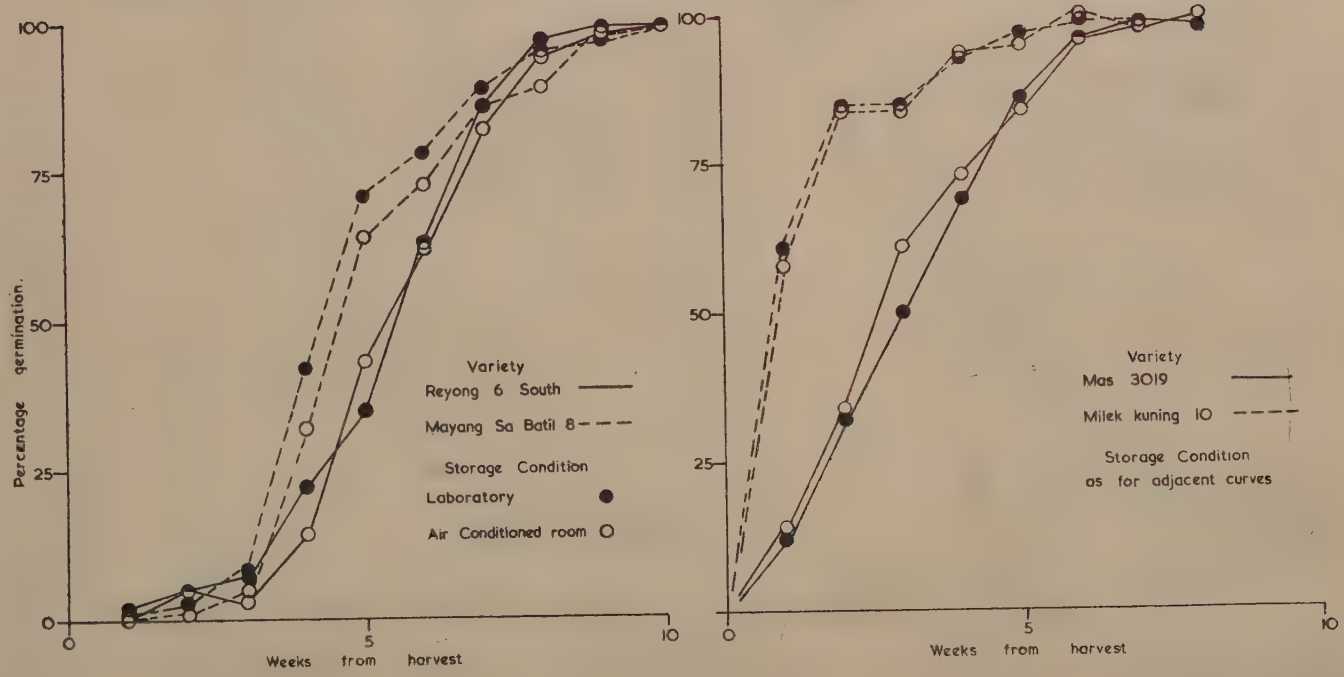


Figure 11.

Effect of storage condition on padi dormancy (2) Varieties showing no differences.



almost constant relative humidity of about 55 per cent and a temperature fluctuation from 68°F to 78°F, that is about 10°F below the ambient temperature. Temperature conditions were the same in the sealed glass containers and the paper bags and ranged from 78°F to 88°F. The conditions in the sealed containers, where the relative humidity was at 0, contrasted strongly to those in the paper bags, where the relative humidity fluctuated from 50 per cent during the day (with maxima during daytime rain up to 90 per cent R.H.) to 80 per cent during the night.

Germination tests of seed samples from each storage condition have been carried out at monthly intervals from the receipt of the seed until the present time. Each test sample was of 50 seeds, and the varieties used were Mayang Ebos, Subang Intan 117, Pebifun, Seraup Kechil 48, Ranggon and Serendah Kuning.

Results.

The results obtained are presented in Table IV, and the mean results are shown graphically in Figure III. The figures in Table IV are the means of three consecutive months, and they show clearly the differences caused by the storage treatment.

Storage in the lower temperature and humidity of the air-conditioned room maintained the viability of all the varieties studied, whilst under the more rigorous laboratory conditions all the seed lost its viability within 15 months. The seed stored in the dry, but at fluctuating temperatures, did not behave uniformly. Under these last conditions, Pebifun and Serendah Kuning lost all viability in 18 months, Mayang Ebos lost all viability in 33 months, Seraup Kechil 48 has only recently (June, 1955, i.e. 39 months) lost all viability, and the remaining varieties, Subang Intan 117 and Ranggon, have maintained quite a high viability over nearly three and a half years. These differences in response do not appear to be related to any other feature of the varieties.

Discussion and Conclusions.

It has been established for 20 out of 21 varieties that the period of dormancy is under 10 weeks, and thus not likely to be of importance to the majority of padi planters, who do not plant a follow-on off-season crop. Where a second crop is planted close on the first, however, it is necessary to know when the seed from the previous harvest can be expected to have maximum viability. As only relatively non-photosensitive varieties can be planted as a second crop, only Radin Siak 34, Acheh Puteh, Seriap and Pebifun of the varieties tested have any potential practical use, and of these only Pebifun is completely insensitive to day length variations in Malaya.

The results obtained are of more importance as a research tool, as it is necessary to commence new experiments immediately after the previous harvest.

In Ceylon and India, where dormancy periods are of much greater length and off-season cropping is more extensively practised, it is important to know

Figure III.

The effect of different storage conditions on the viability of padi.

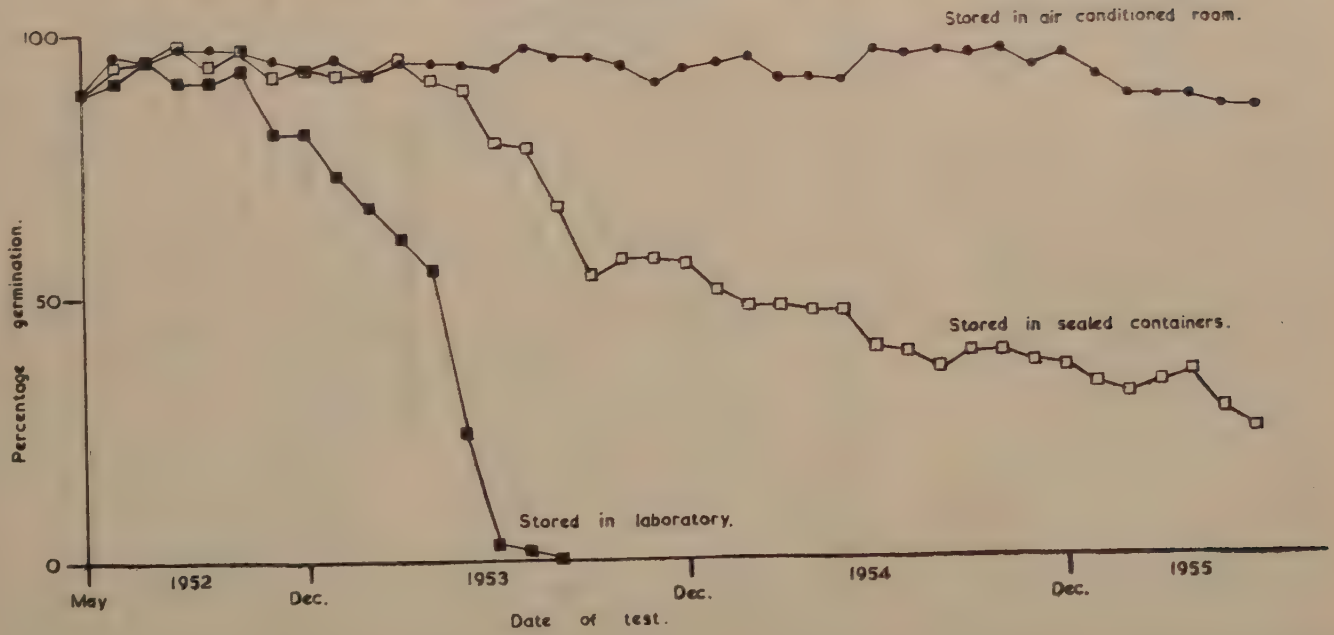


Table IV.

Viability of Seed under Different Storage Condition.

Padi Variety	Treatment	Percentage Germination (successive tri-monthly means) [1]												
		1	2	3	4	5	6	7	8	9	10	11	12	13
Mayang Ebos	A[2]	99	100	99	97	99	97	97	98	99	100	100	97	96
	S[3]	99	97	97	94	69	61	76	46	25	13	7	0	0
	L[4]	99	96	87	87	17	0	0	0	0	0	0	0	0
Subang Intan 117	A	100	100	100	98	99	98	99	100	99	100	99	98	94
	S	100	99	98	99	99	98	97	87	91	94	87	90	75
	L	100	95	93	90	7	0	0	0	0	0	0	0	0
Pebifun	A	97	99	99	97	99	97	93	93	98	97	98	92	93
	S	96	100	93	94	79	15	0	0	0	0	0	0	0
	L	93	93	69	28	1	0	0	0	0	0	0	0	0
Seraup Kechil 48	A	88	85	79	77	81	78	74	78	75	84	83	49	57
	S	84	87	77	78	80	63	59	60	43	25	21	15	1
	L	79	79	76	52	13	0	0	0	0	0	0	0	0
Ranggon	A	79	100	93	93	91	97	97	94	97	99	95	95	93
	S	79	100	96	97	93	95	93	93	94	93	96	88	87
	L	81	99	98	68	16	0	0	0	0	0	0	0	0
Serendah Kuning	A	97	100	96	97	99	95	95	90	92	93	92	93	90
	S	96	96	93	91	76	25	0	0	0	0	0	0	0
	L	96	89	69	17	3	0	0	0	0	0	0	0	0

1 The three-monthly means commence with the period May to July, 1952, and finish with the period May to July, 1955.

2 A = Storage in air-conditioned room.

3 S = Storage in sealed container.

4 L = Storage in laboratory.

the dormancy period of a particular variety of seed. Under Malayan conditions, dormancy in padi seed is at present relatively unimportant.

Interesting features which the present tests on dormancy have revealed are, firstly, the shorter dormancy period of Malayan varieties compared with similar Ceylonese varieties, and, secondly, the possible effect on dormancy of the lower temperature and humidity of an air-conditioned room.

The experimental storage of a number of varieties under different conditions has, in contrast to the dormancy period, far-reaching importance.

In seed storage experiments carried out in temperate climates (9 and 11), it has been found that low temperature and low relative humidity increases the length of life of stored seed. In the tropics and sub-tropics there have been few investigations on seed storage, but White (12) has found that bamboo seed stored over calcium chloride retains viability for some months, while Hopkins (5), investigating the storage of vegetable and cereal seeds, found that the most effective means of preserving seed were, in order of effectiveness, (i) low temperature; low humidity (ii) high temperature; low humidity (iii) low temperature; high humidity (iv) high temperature; high humidity.

The results obtained and reported here show that padi seed is no exception in its requirements for long storage, for the experiment has shown that the viability of the seed is maintained longest in the air-conditioned room (low temperature; low humidity), for a shorter time in sealed containers (low humidity; high temperature), and for the shortest time in paper bags (high temperature; high humidity).

The varieties studied in this experiment do not all behave similarly, but it is logical that such varietal differences are to be expected, and no significance should be placed on them: these differences however are more especially noticeable in the case of storage in sealed containers. Since the containers were opened monthly, it is possible that these large extra-varietal differences have been caused by excessive leakage of moist air into the containers which, if occuring frequently, would reduce viability considerably.

Few padi farmers can store seed in an air-conditioned room, so that the most effective storage for seed purposes would be to keep dry and sound seed in a sealed tin, with a tight fitting lid, and to place a drying agent in the tin as well. This would approach most closely to the conditions of low humidity and high temperature obtained in the laboratory, and would enable the seed to be stored for up to two years. After two years, some varieties will have lost all viability, but as seed would, at most, be kept for seven to nine months (e.g. short term varieties for off-season planting), the reduction in viability in two years would not be of importance.

Seed for experimental purposes is, as far as present data shows, best stored in an air-conditioned room.

Summary.

1. The dormancy periods of freshly harvested padi are shown to be from seven weeks to 11 weeks.
2. There are possible differences in rate of dormancy loss, depending on the storage conditions of the seed.

3. A seed storage experiment showed that seed retains viability for up to three-and-a-half years in an air-conditioned room, and up to two years in sealed containers with calcium chloride.
4. The findings are discussed in relation to previous work, and the practical implications outlined.

Acknowledgements.

I am grateful to the Acting Senior Botanist for permission to use the results obtained in the storage experiment.

Thanks are due to 'Che Ahmat Indot for supervising the germination tests carried out in the storage experiment, and to the Junior Agricultural Assistants who assisted in carrying out these tests.

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THE INTRODUCTION OF A ROTARY DRIER IN THE MANUFACTURE OF CHINA TEA IN MALAYA.

BY

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Introduction.

The tea bush has been known in China for several thousands of years but appears to have been grown as a medicinal plant up to the sixth century A.D., when it became a popular beverage. It is generally known botanically as *Camellia sinensis*, but no true wild plants have been found in China, though they may occur in the Yunnan hills; it is in the mountainous region that separates India from China that the tea plant occurs naturally, and a wide range of types has been found in the Assam and Kachin hills around the upper reaches of the Irrawaddy and Salween rivers, which on study, at the Tocklai Experiment Station of the Indian Tea Association, would appear to belong to at least three distinct species, or sub-species, provisionally distinguished as *Camellia assamica, Camellia cambodia,* and *Camellia sinensis*. The two main distinctions of commercial tea, China and India, may therefore be derived from two different species of *Camellia.*

The China tea bush, which is chiefly grown in China, and is seldom seen in Malaya, is distinguished by its small halist, and small, comparatively thick leaves. It is not as productive as the Indian types, nor does it grow well on the plains. The Indian types of Assam and Manipuri origin are the more common teas of world trade, and are those cultivated on estates in Malaya, both in the lowlands and in the hills. The bushes and leaves are much larger than those of the China type.

The tea of commerce consists of cured young leaves and leaf buds of the shrub. There is some confusion concerning the classification of China tea, which is commonly but incorrectly called "Green" tea. In the manufacture of China tea a limited but controlled fermentation of the leaf is allowed, whereas in the process of manufacturing "Green" tea the fermentation enzyme in the leaf is destroyed by subjecting the leaves to steam as soon as is practically possible after picking the leaves from the bushes.

The Manufacture of China Tea.

The processing of China tea is a cottage industry in Malaya and no machinery is used. The tea holdings are usually small and the management of them is often undertaken by members of one family. It follows therefore that under these conditions of management the quantity of leaf cured on a holding is small. Variations in the method of processing do occur from district to district, but it is not proposed to describe here in detail the different methods used.

PLATE I.

Rolling the bag of leaves by hand.

PLATE II.

Withering leaves under shade.

PLATE III.

Side view of the rotary drier showing the hand lever control.

PLATE IV.

The rotary drier with a full load of tea. Note (i) the baffles inside the drum, and (ii) the top of the brick fireplace.

In general, the processing of China tea is as follows:- the tender leaves, after picking, are withered in thick layers under shade, often on the floor of the curing shed. The withered leaves are then placed in a *kuali* (a cast iron pan) which has been previously heated over a charcoal or wood fire to a temperature of about 250° to 280°F. The leaves are kept moving in the pan by a hand-operated, wooden, paddle-like agitator until the leaves become flaccid, the process taking about 15 minutes. The leaves are then placed in a bag and rolled by the hands or feet on a cement or wooden floor for about two hours. Next, the rolled leaves are placed in a *kuali* which has been heated to a temperature of 200°F and are agitated at that temperature until the leaves become crisp and dry.

In view of the high price of imported China tea (about $2 per lb.), a fair quantity of it is grown in this country and cured by experienced Chinese tea-makers. The types grown are of *assam* and *manipuri jats*. The cured teas from these types, being inferior in quality to that of imported teas, are often blended with imported teas before packing and sale. There are a number of manufacturers of China tea in Malaya and in all cases the curing process is as described above. The labour employed for curing is either paid a daily wage or engaged at contract rates, and at present wage rates the cost of manufacture is regarded as high. Because of the high cost of manufacture, experiments were undertaken by the writer to introduce a mechanical drier for drying China tea at Cameron Highlands in order to reduce these costs.

The Rotary Drier.

As a first step towards mechanisation it was decided to introduce a suitable mechanical drier to replace the age old *kuali* method of drying tea.

In the *kuali* process, each pan is capable of taking only 100 lb. of partially treated leaf per charge, and each pan has to be attended by a man or woman operating the agitator. Each charge is agitated for about four hours and produces 30 lb. of made tea. In an attempt to improve on the efficiency of this process, a mechanical drier was constructed from an unserviceable cement mixer having a capacity of 5 cu.ft.

The drum was removed from the cement mixer and modified as follows:- the baffle-plates were made slightly longer to extend to the full depth of the drum, and the angle between them was increased to facilitate a better mixing of the leaf and to reduce the depth of fall of the tea leaves while the drum was in motion. The objects of these alterations were to give the tea an even, slow drying, to reduce the percentage of the "dust" grade in the made tea and to give the finished product a well twisted appearance.

The drum was mounted in an iron frame firmly anchored to the floor, to enable the drum to be rotated by a belt driven from a 5 h.p. diesel engine. The drum was so mounted that it could be locked at an angle of 45° when it was revolving with the load of tea, and, when the drying of the tea was complete, could be tilted automatically by a hand lever to empty its contents.

A fireplace, with brick walls, was built on the floor under the drum to provide the necessary heat.

In the process of drying the leaf the drum is revolved at a speed of 15 r.p.m. and the temperature inside the drum is maintained, by a wood fire, at about 200°F. The drum has a capacity of 90 lb. of made tea and the time taken to complete the drying is about three hours, depending on the amount of moisture in the leaf at the time of charging the drum.

The opinion of tea manufacturers at Cameron Highlands is that the rotary drier produces a tea of good quality with a low percentage of the "dust" grade in the made tea. The manufacture of tea by the rotary drier reduces the cost by $8 per pikul* compared with the *kuali* method, as is shown in the following table:-

Item	Contract Costs per Pikul of Tea	
	Kuali Process	Rotary Drier Process
	$	$
Contract rate for manufacture of one pikul of made tea	20.00	14.00
Picking out stalks and coarse leaf after manufacture	5.00	5.00
Firewood	4.00	2.00†
Packing (including cost of gunny bag)	1.00	1.00
Total	30.00	22.00

† Includes cost of oil = 50 cents.

Summary.

Tea produced by the rotary drier shows good appearance and has a good storage quality.

The percentage of the "dust" grade in the made tea is reduced from 12 to 5.

The cost of manufacture of tea is reduced from $30 to $22 per pikul of made tea.

Acknowledgement.

The writer wishes to thank Mr. Lew How Sin of Ringlet for his assistance and co-operation in undertaking trials with the drier.

* 1 pikul = 133⅓ lb.

NOTES ON CURRENT INVESTIGATIONS (RESEARCH) APRIL TO JUNE, 1955

Compiled by the Chief Research Officer.

Padi.

Variety Selection.

Records for last season of most of the ear row selection projects have been received and examined. Results generally are satisfactory, though selection in Perak was impeded by the unusually widespread outbreak of the physiological disease *penyakit merah* in Krian. At Telok Chengai, Kedah, a dozen or more lines continue their promise to outyield R.C.4 and M.E.80 in ear rows, and the final selection trial has proceeded satisfactorily in its first year. At Kota Bharu, Kelantan, one or two very promising lines of Anak Naga are beginning to appear, one line giving the highest yield this season in all three replicates, though it behaved relatively poorly in previous seasons.

Results of Selection.

Regional trials carried out last season with Nachin 5057 in coastal *mukims* (parishes) of Malacca have demonstrated the possibility of increasing yields over the 17,000 acres of land in this area by 20 per cent.

Similar trials with three selections of Serendah Kuning in Negri Sembilan have confirmed their superiority over the unselected variety. While in 1953-4 they gave an increased yield of 8.7 per cent, in the past season an increase of 18.9 per cent has been obtained. This represents a potential increased production of milled rice in this State of from 2,000 to 3,000 tons. A fuller account of these trials is being prepared.

Variety Trials.

Programmes of varietal work for the coming season have been prepared and forwarded to all States except Selangor. These programmes cover 52 variety trials, 14,600 ear rows for pure line selection, 1,100 seed lines, 250 observation plots and five variety collections containing some 1,150 varieties. Activities relative to the coming season are proceeding normally and in several States sowing of nurseries is well under way.

Plant Growth Studies.

Photoperiodism.

Experiment P.326, dealing with the effect of varying daylengths on a number of varieties, has been completed and the results are being analysed. It has been shown that variation of photoperiod produced no effect on flower formation within the first four weeks after germination. A further point of interest noted is that the development of secondary tillers is related to the number of long days to which the plant is subjected, but this varies according to variety. A fuller report of this experiment is being prepared.

Water Control.

A report on Experiment P.327, comparing growth of padi in various depths etc. of water, is being prepared. Some of the effects are as follows:- depth of water had no effect on final height, but stagnant water produced shorter plants; deep water caused more rapid growth in height in the early stages and slower growth in the later ones; the deeper the water the fewer the tillers produced; varying water depths variously affected the intervals between tillering, initial flowering, final flowering and maturity, but had little effect on total maturation period; and the treatment in 8 in. of water gave the highest grain yield and that in saturated soil with no superimposed water the least; the latter treatment was most affected by stem borers, however.

HYBRIDISATION.

Populations of both local and Cuttack *japonica* hybrids are still actively segregating and, beyond a steady general improvement in the quality of the material as a result of selection, progress cannot be assessed. The following material has been selected for planting in the coming season:-

Hybrid		Pulau Gadong, Malacca		Telok Chengai, Kedah		Total	
		Ear Rows	Progeny Plots	Ear Rows	Progeny Plots	Ear Rows	Progeny Plots
Local *indica*	F_5	667	9	530	9	1,197	18
	F_4	1,390	28	1,752	28	3,142	56
	F_3	—	16	1,042	15	1,042	31
indica x *japonica*	F_5	254	4	313	4	567	8
	F_4	1,413	34	978	27	2,391	61
	F_3	239	14	15	2	254	16
	F_2	—	6	—	—	—	6
Total		3,963	111	4,630	85	8,593	196

PEST CONTROL.

Stem Borers.

During the current off-season, six well-defined plant communities in Krian have been mapped by the Entomologist in which the dominant plants are various species of large and small sedges, woody herbs and grasses, and a mixture of sedges and herbs. The plants comprising the padi field flora are seen to be divided into seven different groups. Grasses comprise about 10 per cent of the padi lands in Krian but, as expected, they are less attractive to the borers than is padi. Only two alternative plant hosts of the stem-borer *Chilotraea polychrysa* (Meyr.) have been recorded, one is *Panicum amplexicaule* (previously recorded in 1932 as *Hymenachne myuros*) and the other, *Echinochloa crus-galli.*

Disease Control.

Fungicidal Seed Dressing.

Laboratory experiments are still in progress, using organic mercurial fungicides. So far, best results appear to be obtained by using a dry fungicidal dressing before soaking the seeds. Other aspects of the problem which are being investigated are the effect of seed treatment on the viability of seed in storage and the influence of the age of the seed on the results of seed treatment.

Seed-borne Fungi.

Isolation of fungi from padi seeds so far carried out shows that of the pathogenic species *Helminthosporium oryzae* and *Trichoconis padwickii* are by far the most commonly encountered. Other pathogenic fungi isolated include species of *Curvularia*, *Pestalotia*, *Nigrospora* and *Fusarium*.

Cacao.

Selection and Breeding.

A total of 4,700 pods from experimental fields has been analysed for bean content.

Compatibility testing and other routine work has continued normally, and some 800 flowers were self pollinated.

Two hundred cross pollinations between selected trees have been carried out; set of flowers was good but many cherelles subsequently wilted. A total of 1,070 seed of 14 different progenies has been despatched to the Federal Experiment Station, Jerangau, Trengganu, for establishment of progeny testing and selection blocks. This first exploratory phase of the breeding programme, based on selections made up to last November, will shortly be completed.

Fermentation and Drying.

The work mentioned in the previous Report has continued. Arrangements have now been made for single-pod fermentation to be carried out for selection work. The fermented, dried cocoa will be prepared for selection on yield per pod basis only.

Samples of the first large-scale box fermentation at the Federal Experiment Station, Serdang, have been examined and work on them is still in progress. Their quality has been reported and samples forwarded to Trinidad for the world survey of fermentation methods.

Oil Palm.

Dumpy seed distribution to estates continues as seed becomes available.

Dumpy x pisifera seedlings surplus to the 269 sent to the Federal Experiment Station, Jerangau, have been disposed of to estates.

Some 40 West African selfed tenera and fertile pisifera seedlings have been transferred to large baskets to hasten growth. They will be planted out at the Federal Experiment Station, Serdang, when six months old.

Extraction and Processing.

Work has continued on the factory conditions of extraction of palm kernels. Contact has now been made with three processing factories as sources of material and for the study of actual factory conditions. Indications are that variations in the latter are mainly responsible for the fluctuating quality of palm kernels.

Disease Control.

A disease of young seedlings in which spots and then large dead areas appeared on the leaves resulting, in severe cases, in death was reported from an estate in Johore. Two fungi, species of *Curvularia* and *Gloeosporium*, were isolated from the diseased areas. First pathogenicity tests indicated that the *Curvularia* is capable of attacking healthy oil palm seedlings.

Coconut.

Selection.

Some 560 open pollinated nuts from selected trees at Port Swettenham have been germinated and established in nurseries at Degong Experiment Station, Perak. The first of these should be ready for field planting in two or three months. Collection of nuts from Port Swettenham is continuing. Phenological observations on flowering in two palms adjacent to the laboratories at Kuala Lumpur have continued and hand pollination has resulted in a very considerable increase in fruit set.

Disease Control.

Further investigations were made into an obscure chlorosis, leaf-rot and die-back of young dwarf coconuts and a visit was made to the affected estate in Perak. The cause of the trouble has not been elucidated. Similar symptoms have been observed in another area in the district.

Pineapple.

Chemical Studies of Pineapple Fruit, Leaves and Products.

Work has continued on the analysis of fruits from a potash fertiliser experiment (SEL.98) at Jalan Kebun Experiment Station, Selangor. This work is greatly helped by the preservation of fruit in the 13.5 cu.ft. deep-freeze cabinet purchased from Pineapple Industry cess funds.

Weighed portions of fruit have been frozen "dry", without grinding. This procedure was found to be much quicker, and is expected to give more reliable results. The load on the freezer is halved, and the samples are much easier to handle when thawing out for analysis.

The first samples of South African Smooth Cayenne fruit grown on peat soil have been received and subjected to complete analysis. These fruits are grown without manurial treatment, and no significant difference could be detected between them and the Sarawak variety grown on control plots in Experiment SEL.98.

Work continues on the effects of potash treatments on pineapple fruit.

Canning Research Station.

Maturity Tests.

A series of maturity tests has been started on some of the experimental fruit from the Federal Experiment Station, Alor Bukit, Johore. The object of this test is to find the relationship if any between the ratio of the soluble solids and acid with the skin colour of the fruit.

"Paraffin" Off-Flavour in Canned Pineapple.

With about 200 cans left for examination, an interim report on 1,609 cans examined shows that five experimental batches have contained from 10 to 30 per cent affected cans. This is the highest proportion known to have been produced in controlled experiments. While the ultimate cause is still unlikely to be established, it is expected that examination of the complete results will give useful leads for further experiments.

Pest Control.

Mealy-bugs (Dysmicoccus brevipes).

Fumigation of slips for the field test referred to in the last Report has been carried out under a tarpaulin using methyl bromide at the rate of ½ lb. of the fumigant for 30 min. for each stack of 3,500 slips. Only 2 to 3 per cent of the plants were infested and tests indicated that the methyl bromide gave a good kill.

Disease Control.

Fruit Collapse.

Isolations of bacteria from several fruits at different stages of the disease have been made to discover whether the disease is always caused by the same organism. Purification of these cultures is in progress.

Specimens of diseased fruits from Selangor and Perak have been examined but so far no cases of Fruit Collapse have been found in these areas.

Two more visits were paid to the area in Pontian, Johore, where Fruit Collapse occurs. The Cetoniid *Glycyphana sinuata* Wall. was absent on both visits and the Nitidulids (*Carpophilus* ap. near *foveicollis* Burm. and *Haptoncus occularis* Frm.) were scarce. The area is under a 12 hour curfew and, therefore, night observations cannot be carried out.

Tea.

Selection.

Rooting of the last batch of clonal cuttings at Cameron Highlands showed appreciable improvement and sufficient rooted cuttings are now being transferred to an intermediate nursery for planting the first clonal trial in some six months' time. Work in improving rooting technique is continuing.

Vegetables, Food Crops and Fruit.

Groundnut.

A total of 125 selections has been planted with two replications at Serdang. Germination in one replicate was poor owing to abnormally dry weather just after planting. Further selection will have to be deferred until the next crop.

Soya Bean.

The planting of selections for spring sowing failed at the Federal Experiment Station, Serdang, owing to dry weather and loss of seed viability. A few strains have been lost but sufficient seed for a new planting has been obtained from most strains.

Pest Control.

Replicated insecticidal tests at Cameron Highlands indicate that 25% DDT miscible at 1:160 gave good control of *Plutella maculipennis* Curt. on cabbages but 5% DDT dust was ineffective. No insecticide was outstandingly effective against cutworms (*Agrotis* spp.) on carrots and other vegetables.

Disease Control.

The fungus causing the serious trunk and branch rot of durian at the Federal Experiment Station, Serdang, has been identified by the Commonwealth Mycological Institute as *Nectria ochroleuca*. Dissection of a badly affected tree showed that in the early stages the disease is confined to the bark but later it penetrates deeply into the wood. Control of the disease by excision of diseased tissue will therefore only be possible if treatment is carried out as soon as the disease is observed.

Pasture and Green Fodder.

Analyses of samples from an NPK manurial experiment at the Federal Experiment Station, Serdang, have continued. The modified treatments applied since January, 1955, have so far produced no significant changes in nitrogen content of the grass samples.

Spices.

Trees in four clove plantations in Penang were examined to discover how widespread were the diseases Sudden Death (*Valsa eugeniae*) and Die-back (*Cryptosporella eugeniae*). Of the 78 trees examined, 62 were found to be infected by one or both of these fungi.

Soils Investigations.

Padi.

Soil Survey, Kuala Langat.

Soil sampling has been continued and the survey of the area of 60,000 acres is approaching completion. A large part of the area consists of deep peat.

Soil Survey, Briah.

Soil analyses have been completed and a report prepared. The soil map shows that in the area of 20,000 acres, about 8,000 acres has peat more than 2ft. deep.

Soil Survey, Kedah.

A comprehensive soil survey of cultivated padi lands was started for the first time. Preliminary examination of about 80 soil pits sited systema-

tically over the Kedah Plain indicated that these alluvial soils could be mapped on a series basis, and 18 series were provisionally identified.

Following the setting up of the series, systematic mapping of the area was started south of Alor Star, and five teams, made up from members of the Department of Agriculture, Kedah, were trained in the siting and examination of soil pits. Standard forms of description were used and, after examining, recording and sampling the pits, the soil surveyor identified the soil series before the pits were closed.

About 500 pits, covering 150,000 acres, were examined and a provisional soil map of the area was constructed. The next step was to map the boundaries more accurately, and, for this, aerial photographs on a scale of 2½ in. to 1 mile were used. An 18 in. diameter post-hole auger, fitted to a Ferguson tractor, was used to dig examination bores to a depth of 3 ft. This proved to be a quick method for mapping soil boundaries.

Soil analyses of approximately 1,800 samples taken during the course of the survey have been started.

Kelantan Deficiency Area.

A survey of this area was started on the 17th April. Two parties, headed by retired survey *mandores* (foremen), were engaged to cut traces at mile intervals in the area. Profile pits, 4 ft. deep, were dug every 45 chains, and 3ft. auger borings were examined at five or ten chain intervals along the lines.

The cutting of traces was slowed down considerably in the west of the area where there are large areas of poor jungle, *gelam* (*Melaleuca leucodendron*) and belts of *kelubi* (*Zalacca conferta*). Even the more open areas are difficult to traverse owing to the swampy conditions. In general, padi cultivation in the area has met with little success.

Ten soil series have been indentified in the area and, of these, four fall into the "deficiency group". About one third of the area has been surveyed and it is hoped that the remainder will be completed in July.

Other Crops.

Three oil palm estates were visited and samples from the third and seventh fronds were taken in connection with a survey to study the nutrient status of palms of different ages and in different soil types. Soils ranging from peats to inland sandy soils, and palms ranging in age from seven to 29 years were included.

Trengganu Soil Survey.

The Soil Geologist proceeded to Trengganu at the beginning of April and recommenced the survey of prospective cacao areas which was started last year. While junior staff were being trained in the methods of soil survey, the Soil Geologist carried out a detailed survey of the Federal Experiment Station, Jerangau. This entailed examination of traces at 5 chain intervals, the mapping of swamp areas and the boundaries of the two main series in the area, the Jerangau Series and the Rengam Series.

The Soil Geologist also made an 11 day trip into Ulu Trengganu, following the Sungei (River) Trengganu to Kampong Pasir, Berchang, and thence proceeding up the Sungei Kerbat. Despite the mountainous and hilly nature of the terrain, it is thought that fair-sized areas of potential agricultural land do exist.

Laboratory Technique Investigations.

PLANT SAMPLING.

Stabilisation of Perishable Materials.

(i) *By Freezing.* A deep-freeze cabinet has been put into operation for holding large numbers of pineapple fruit samples for analysis. The use of this cabinet has allowed officers of the Department to take larger and more efficient samples at harvest peak than would previously have been possible.

(ii) *By Drying.* A prototype leaf drying oven is nearing completion at the time of writing. The oven is a fan-blown, electrically-heated type of about 30 sq. ft. shelf area. It is readily transportable, and requires only a 15-amp., three-pin power outlet for operation. The oven is constructed entirely of locally-available parts and materials, costing less than $250. Tests will be started as soon as assembly is complete.

Flame Photometer.

The multiplying unit for the flame photometer has arrived and is in operation. Readings can now be made using very dilute solutions (i.e. 0-10 p.p.m. K, Ca, Na), and magnesium determinations may now be possible.

Cation Exchange Capacity Determination.

This has been done on samples from the Solomon Islands and on a few Kedah soils using the ammonium acetate method. Technical difficulties were encountered with the Kedah soils, perhaps because of the highly colloidal nature of the clay fraction which made washing very difficult. More comprehensive methods using divalent cations in the leaching solution are being tried with a view to development to routine use.

Potash.

Experiments have been completed which show the effect of time of shaking, soil solution ratio, successive extractions, etc., using either acetic acid or water as extracting agents.

Exchangeable Acidity of Kedah Soils.

This value corresponds roughly to the amount of ferrous iron extracted from the soil by K in exchange reaction. This exchange reaction method is not applicable to routine use as yet, but interesting results have been obtained with several *Soils.*

Insect Collection.

The staff of the Division of Entomology prepared for shipment to the British Museum (Natural History) the bulk of the insect collection of the former Selangor Museum. It comprised about 100,000 specimens sent in 665 store boxes and was reported as having reached London in excellent condition.

NOTES ON CURRENT INVESTIGATIONS (AGRONOMY)
APRIL TO JUNE, 1955

Compiled by the Senior Agronomist.

Padi.

It is now off-season and agronomic programmes have been finalised for next season. Arrangements have been made to lay down large numbers of a simple three-plot trial in most States and Settlements in order to compare the effects of 'equivalent' dressings of soluble and insoluble phosphate in the presence of adequate nitrogen and potash. This is an important practical trial because many field experiments have suggested that a somewhat heavier dressing of the insoluble form is as effective and considerably cheaper than soluble phosphate. In this instance the dressings are equivalent neither in cost nor in nutrient content but in estimated effect.

Fundamental experiments on Experiment and Test Stations are being continued.

Eleven acres of land is being cultivated at the Bukit Merah Padi Experiment Station, Province Wellesley, with off-season Taiwan padi. In this area the experimental programme has been adjusted to meet the new conditions whereby cultivators have chosen to plant two crops a year of Taiwan (*japonica*) varieties.

On smallholders' land, simple manurial trials continue to reveal good responses from fertiliser. It will suffice to quote results from one series of 145 trials completed last season on wet padi in Trengganu. These are summarised below:-

Mean yield of manured plots	-	1,930 lb. per acre
Mean yield of non-manured plots	-	1,372 lb. per acre
Increment due to manuring	-	558 lb. per acre

[100 *gantangs* (gallons) per acre]

The fertiliser dressing here was 200 lb. per acre of a balanced mixture with analysis 12 : 12 : 6 = N : P_2O_5 : K_2O. This contained 13 per cent of double superphosphate (40 per cent P_2O_5) and 19 per cent of Christmas Island rock phosphate. The fertiliser cost the smallholder about $30, and this increment, even at present reduced prices, was worth at least $48.

Cacao.

Many important trials are in progress at the Federal Experiment Stations at Jerangau, Trengganu, and Serdang, Selangor. At the former station, a halting bungalow has recently been completed and this will greatly facilitate visits by officers from Headquarters.

In a lime-phosphate trial which was planted at the Jerangau station in September, 1954, there are now marked differences in vigour of growth and it seems clear that limestone has the same beneficial effect as phosphate during the first eight to 10 months from planting.

Cacao seeds grown under hard conditions in a sandy soil have not transplanted well; under softer conditions, with a more cohesive soil type it has been possible to transplant seedlings with a ball of earth around the roots and this has led to fair results.

Some important observations have been made in Trengganu on the effect of different forest shade trees on the health and vigour of nearby cacao. It has now been established that *Shorea Leprosula* definitely has a harmful effect on cacao and it seems possible that this applies, to a greater or lesser extent, to most Dipterocarps. It would seem unlikely, therefore, that cacao and *meranti* timber can be raised together economically. *Trema* is another genus of forest tree which appears to suppress cacao growth. Suitable shade genera would seem to be *Parkia*, *Durio*, *Sterculia*, *Mallotus* and *Macaranga*.

At Serdang, a field of cacao has been replanted using ground shade of *Indigofera teysmanni* which was later allowed to develop into secondary shade. This has proved to be an excellent shade tree and is probably superior to *Gliricidia sepium*.

It has been found to be beneficial, when transplanting cacao seedlings with bare roots, to dip these roots into a phosphate slurry such as is used by Malay padi planters. However, the operation is a tedious one which slows down transplanting, and it seems likely that the same effect could be achieved by applying dry rock phosphate round the bare roots at the time of planting.

A seed garden at Serdang which was planted with Amelonado cacao under cultivated shade in April, 1950, yielded at the rate of 194 lb. dry cacao per acre during the first six months of this year. This was somewhat less than was expected because of very wet weather during flowering.

Amelonado cacao continues to thrive on a Lower Perak estate under shade of old coconuts, and the area planted has been increased to 10 acres.

Coconut.

There has been a visual response to fertilisers in a simple manurial trial situated on coastal sand on the Trengganu coast. With an apparently greatly increased fruit set there has been a marked increase in squirrel damage, but arrangements have recently been made for regular shooting. The first application of fertilisers was given only in August, 1954, so it is too soon to expect large yield differences.

Oil Palm.

The excellent growth of young palms in three variety trials at the Federal Experiment Station, Jerangau, in Trengganu, is most marked. In the most advanced trial, 373 palms out of a total 384 are bearing fruit bunches and considerable damage from wild pig has been recorded.

Disposal of the crop on this station will be a problem since there is no factory available in the vicinity.

In a replanting experiment at Serdang, the effect of a kieserite dressing given in February, 1955, has become more obvious. All young fronds are now a healthy, deep green with no sign of yellowing. Nevertheless, young palms which were planted three years before felling the old stand still remain stunted and backward.

Manila Hemp.

Tangongon has outyielded Bangulanon and four Temerloh selections in a variety trial at Sungei Ruan, Pahang. The Tangongon yield was equivalent to only about 900 lb. per acre of clean dry fibre. The site is undulating and the soil similar to the Rengam Series.

On well-drained alluvial clay at Degong, South Perak, a half-acre block of Tangongon is now yielding at the rate of 1,699 lb. per acre per annum of dry fibre. This is quite satisfactory.

Pineapple.

In a rate of potash experiment at the Federal Experiment Station, Jalan Kebun, Selangor, the third harvest of the Singapore Spanish variety is nearly over and harvesting of the Sarawak variety is in progress. Control plots of both varieties are showing marked signs of potash deficiency: growth is poor and there is severe leaf-tip necrosis starting on the older leaves and spreading later to all. In addition, with Singapore Spanish, there is much yellowing and reddening.

The best vegetative growth of Singapore Spanish appears to be on the plots receiving 100 lb. K_2O per acre. At higher rates there is leaf-tip burn and reddening or yellowing—possibly due to a lack of balance of nitrogen and potash.

In a phosphate and magnesium trial, the former nutrient has little visible effect on growth in the presence of potash. Magnesium applied as kieserite leads to a yellow leaf-coloration and has a slight suppressive effect on growth.

In a minor element experiment, it has been established that even a 1 per cent nutrient spray of copper sulphate will cause leaf damage, whereas Bordeaux mixture has no such harmful effect yet is equally beneficial in preventing or curing green die-back.

In a ridging and spacing trial, close spacing is doubly beneficial with the Sarawak variety since it prevents lodging and reduces fruit size. Ridging is beneficial when drainage is poor but should be avoided elsewhere as it increases the tendency for fruiting stems to lodge.

Development of new land at the Federal Experiment Station, Alor Bukit, Johore, has recommenced with the recent release of funds. Road construction and the removal of buried timbers are in progress.

Nutrient spray trials have been planned for both peat soils and coastal sands.

Spraying with the equivalent of 20 lb. per acre of sodium pentachlorphenate and 10 lb. per acre of pentachlorphenol has given almost complete control of weeds in a drain for over three months and also for a similar period between rows of mature, widely-spaced pineapples.

Tobacco.

In an arable rotation experiment at Jalan Kebun, Selangor, an excellent crop of tobacco has been grown. Growth on unlimed plots was better than on the corresponding limed plots and there appeared to be a benefit from

increased burning of the surface peat. Harvesting and sun-curing are in progress.

Vegetables and Food Crops.

Cauliflower variety trials with some new strains of American origin are being repeated at both Cameron Highlands and Kuala Lumpur. At each station the superiority of the local varieties is again evident.

At Kuala Lumpur, a Lobak variety trial to compare one Indian, three Japanese and two local strains has been laid down. Establishment is good. At the same station, a Pak Choy variety trial to compare five Japanese varieties with two local ones of known merit has been planted. Establishment is only fair.

Rubber Intercropping.

In a large intercropping trial of hedgerow rubber which is in progress on Malacca Series soil at Gajah Mati, in north Kedah, the intercultivation of cacao has been abandoned. One of the treatments concerned has been altered to selected kapok and nurseries of this crop have been established.

The rubber seedlings of this trial have been budded with Tj. 1, R.R.I. 501, P.R. 107 and AVROS 157.

Livestock.

Pigs.

At Pulau Gadong, Malacca, a pedigree Wessex boar has now served a total of 38 local sows in a simple progeny trial. Fifteen sows have so far farrowed a total of 156 piglets. Carcase quality of the resulting porkers will later be assessed. Growth rate is superior to that of the standard Chinese Black x Middle White cross.

Freshwater Fish.

Fish rearing trials in ponds have finally been abandoned at Cameron Highlands because of poor yields from both *Tilapia* and carp.

NOTES ON EXTENSION WORK
APRIL TO JUNE, 1955

Compiled by the Acting Chief Field Officer.

Padi.

MAIN SEASON.

In spite of the exceptionally dry weather experienced in the previous quarter, which adversely affected padi yields in the north-western States, the estimated total production of padi in the Federation is already slightly greater than in the preceding season, with small areas still to be harvested in the south. The largest improvements in yield of wet padi were contributed by Kelantan, Trengganu and Malacca while the biggest reductions occurred in Kedah and Perlis.

Although the results of all the extension manurial and varietal trials have not yet been received, the early indications from these trials are being borne out by actual harvest yields, and reports of highly satisfactory increases resulting from the use of fertilisers and of selected varieties are being received. These extension trials are all located on cultivators' own land, with their permission and active co-operation, and while the Department supplies all the necessary fertilisers and seeds and instructions for their use, the cultivator performs the cultural operations and retains the crop for his own use; in this way, the Department forges a close link with a representative section of the padi planting community. There were 2,495 such extension trials during the past season, and these trials not only supply valuable information to the Department on the performance of various fertiliser dressings and selected varieties over a very wide range of conditions, but they also serve as visual demonstrations of the advantages of employing the latest improvements *under actual padi planters' conditions*, as distinct from the somewhat artificial conditions obtaining at Padi Test Stations.

In the great majority of cases it is found that cultivators co-operate with enthusiasm and, through an understandable desire to boast of their connection with the Department and the superiority of their extension plots, they unwittingly become publicity agents for Departmental extension lines; furthermore, in the case of extension varietal plots the cultivators are, in effect, bulking agents for improved varieties and, in Malacca for example, the Department undertakes to pay a bonus of 15 cents per *gantang* (gallon) for selected strains sold for seed purposes from these plots.

Although the Government support price for padi remained at $12 per *pikul* (133⅓ lb.), there were indications that millers were competing among themselves for stocks, and by the end of the quarter the price had risen to $13 in Selangor and to an average of $14.40 for the second half of June in Kedah, reaching as much as $14.90 on one day.

Arising out of the recommendations of the Federal Rice Committee, the Padi Cultivators (Control of Rent and Security of Tenure) Ordinance,

1955, was passed by the Federal Legislative Council in April, and arrangements have been made to implement this Ordinance in the main padi-growing areas of Kedah in time for the 1955-56 season.

Arising also from the Federal Rice Committee's recommendation to disburse $15,000,000 to alleviate hardships resulting from the reduction of the Government support price for padi from $17 to $12 per *pikul*, State and Settlement Governments have formed their own Rice Committees to consider ways and means of utilising their allocations from this source. State and Settlement Agricultural Officers have played a leading part in these deliberations and in a number of cases have put up detailed schemes designed to benefit the largest possible numbers of padi planters. In Kedah, for example, it has been decided to place the allocation, amounting to some $4,600,000, in a Fund to be administered by a Board consisting largely of representatives of Padi Cultivators' Associations, and to be used primarily for the redemption of padi land subject to *jual janji* agreements (mortgages) and to use the income from rents on these lands for the common good of padi cultivators. In Kelantan and Malacca, a large proportion of the allocations will be used to subsidise the purchase and distribution of approved padi fertiliser mixtures over the next three or four seasons, and, in Malacca, provision will also be made for subsidising the production of bulk supplies of selected strains of seed padi from approved Seed Farms.

With the object of fostering a competitive spirit among groups of padi cultivators, an inter-*mukim* (parish) padi growing competition was introduced in the Alor Gajah District of Malacca. Frequent visits were paid by Departmental staff throughout the padi season and marks were awarded on standard score-cards for the following points:-

(i) general adherence to padi planting dates;
(ii) proportion of cultivable padi land in the *mukim* actually planted during the season;
(iii) standard of maintenance of subsidiary irrigation canals, drains, bunds, etc;
(iv) general standard of husbandry during the season, e.g. attention to weeding, pest control measures, etc; and
(v) assessment of crop yield in relation to *sawah* (padi field) classification;

Sungei Baru Ulu was adjudged the winning *mukim* and a bonus of $50 was awarded to the *Penghulu* (Headman) and $25 to each of the four *Sidangs* (Assistant Headmen); in addition, all the cultivators concerned were invited to a *khenduri* (feast) in June, just prior to the commencement of work for the coming season. There is no doubt about the keen rivalry which has been stimulated by this competition, and an improvement in the general standards of husbandry is ensured in coming seasons. It is intended to widen the scope of this type of competition to embrace other Districts in Malacca and eventually to hold inter-District competitions also.

All States and Settlements held Padi Seed Competitions during the period under review and the best exhibits in each case will be entered for

the Pan-Malayan Padi Seed Competition to be held under the auspices of the Malayan Agri-Horticultural Association in August.

Distributions of seed padi during the quarter amounted to 25,025 *gantangs* of selected seed, and 1,830 *gantangs* of unselected seed; the majority of this was supplied to areas which had experienced crop failures in the previous season as a result of drought, flood or the ingress of sea-water.

Off-Season.

In the Central District of Province Wellesley, where nearly 7,000 acres is normally cropped with padi during the off-season, it was agreed by the cultivators that no irrigation water should be supplied during the present off-season with the joint object of permitting essential repairs to be made to the distribution canals and of allowing cultivators to get into step with correct planting dates: however a large number of cultivators decided to take the risk of an uncertain supply of water from rainfall, and a total of 4,355 acres was planted. The growth of the crop has not been good and, due to inadequate rain, water has been short, weed growth heavy and crop prospects are poor.

In Kelantan, a pilot off-season padi project initiated by the Department at Lundang Paku was subjected to severe handicaps imposed by the abnormally dry weather in April; however, with valuable assistance from the Drainage and Irrigation Department, these were overcome and some 30 acres was planted by the end of May; and growth generally has been very good indeed.

In Malacca, a similar small pilot project on rain-fed land ended in total failure due to exceptionally dry weather and a succession of serious pest attacks comprising insects, rodents and birds; although no crop was obtained, initial growth was sufficiently good to impress the cultivators and they have expressed their intention to try again next off-season.

Rubber.

There was no fall of seeds during the quarter, but attention was directed to maintaining the best possible growth in nurseries previously established; this proved difficult in several localities due to unusually dry weather, and fairly heavy losses and retardation of growth were experienced in nurseries sown since the beginning of this year.

An estimate of the number of stumps in the ground on the 30th June which are expected to be of pullable standard during the planting-out period August to December, 1955, gave a total figure of 6,346,500. This figure does not take into account the numbers of stumps already distributed this year from 1954 nurseries, nor the number of stumps which will not be pullable until the early planting-out season in March to May, 1956.

During the period April to June, 1955, the number of stumps delivered to the Rubber Industry (Replanting) Board for distribution to approved replantings totalled 505,173, and a further 80,213 stumps were distributed for new plantings, the totals to-date this year being 741,289 and 149,948 stumps respectively, valued at $133,685.

During the same period, 30,779 yards of budwood of approved clones was cut from nurseries on Agricultural Stations and delivered to the Rubber Industry (Replanting) Board for replanting, and 18,452 yards was distributed direct for new plantings; the total yardages to-date this year are 54,588 and 32,297 respectively, valued at $13,032.

In terms of acreages planted, the foregoing figures represent a distribution during the quarter of sufficient planting material to establish 4,064 acres of replantings and 1,323 acres of new plantings, the relevant figures for the first half of the year being 6,435 and 2,364 acres respectively. When considering these acreages, it should be remembered that the main planting season occurs in the last half of the year.

By arrangement, experts from the Botanical Division of the Rubber Research Institute inspected all Department of Agriculture rubber budwood nurseries throughout the country with the object of checking and advising on the purity of the various clones established in them. From the reports received on each individual nursery, a fairly satisfactory state of affairs was found to exist, but a number of rogues was found in most nurseries, due to the growth of stock shoots, over-budding or the use of impure budwood; immediate steps were taken to eradicate these rogues and, where feasible, to replace them with the correct clones.

Fruit.

The weather during the second quarter was not, in general, particularly favourable for the establishment of budded fruit plants; however, 9,531 such plants were distributed during that period, many of them to the Rubber Industry (Replanting) Board for establishment in holdings which had been approved for fruit as an alternative crop. Large stocks of budded fruit plants are being held in most Agricultural Stations awaiting more favourable planting weather before distribution.

Preparations are being made at all Agricultural Stations to plant up new stock beds with seed obtained from the current fruit season; fruit budwood nurseries are also being extended, where necessary, to ensure an adequate supply of scion material in anticipation of increased demands, particularly from the Rubber Industry (Replanting) Board.

Cacao.

The "Report of the Working Party Set Up to Consider the Development of a Cacao Industry in Malaya" was published in June. The most important recommendation, as affecting the Department of Agriculture, was that dealing with the establishment of pilot schemes, of which three of 50 acres each are envisaged for 1956. The objects of these pilot schemes are primarily to demonstrate the technique of growing cacao on a *kampong* (village) scale and to train smallholders in the methods of establishing and maintaining cacao smallholdings.

Pineapple.

In Johore, manurial demonstration plots have attracted much attention, and it is encouraging to note that one owner reported not only a marked

increase in the number of fruits harvested but that the price he received for his crop had gone up by two cents per fruit as well.

There has been a good fruit season in Selangor, and 664 acres has been alienated to smallholders in Batu Sapuloh and Jenjarom for planting with pineapples; a further 20 acres has been planted up at Sekinchang.

Coffee.

Prices for prepared Liberica beans have shown little change and, in Klang, Selangor, have kept within the range $190 to $215 per *pikul*. Fresh berries fetched $20 to $25 per *pikul*, and selected berries for seed, $40.

There has been no slackening of interest in planting this crop in Selangor, where 6,200 seedlings were distributed from Departmental nurseries, nor in Johore, where 84 acres were planted during the quarter.

Coconut.

In Johore, smallholders have shown interest in supplying vacancies, slashing undergrowth, deepening drains and constructing bunds to prevent the ingress of seawater; interest has also been sustained in replanting and new planting.

River clearance and bund construction by the Drainage and Irrigation Department has also greatly assisted in the control of water, both fresh and salt, which is the major problem in the coconut areas on the west coast of Johore.

Manila Hemp.

The *kampong* nursery at Ulu Lunsom, Temerloh, Pahang, is making good progress under Departmental guidance, and the 100 suckers supplied are growing satisfactorily. A further 100 suckers will be planted shortly and 40 acres of land is being cleared for eventual field planting.

Livestock.

Pigs.

The stock-rearing centre at Cameron Highlands continued to be the main source of supply for pure-bred Middle Whites, distributed for crossing with and upgrading the local Chinese breed, and was responsible for more than half the total distributions, amounting to 91 boars and 50 gilts during the quarter.

The following returns of pigs slaughtered at the Malacca abattoir during the quarter show that more than 50 per cent of all pigs were Middle White cross-breds:-

Month 1955	Total No. of Pigs Slaughtered	No. of Middle White Cross-bred Pigs Slaughtered
April	2,356	1,234
May	2,201	968
June	2,409	1,375
	6,966	3,577

Poultry.

The State Agricultural Officer, Selangor, made three importations of hatching eggs by air from England during the quarter. Some eggs, or chicks from these importations, were distributed to State and Settlement Agricultural Departments in Malacca, Pahang, Kelantan, Trengganu and Negri Sembilan and the balance retained in Selangor. The breeds imported were Rhode Island Red, White Leghorn and Light Sussex, and hatches from these eggs varied from 50 to 70 per cent; deaths among chicks hatched have been negligible.

The numbers of cockerels, pullets and hatching eggs distributed during the quarter were 543, 480 and 4,131 respectively.

Goats.

A post mortem examination carried out by the Veterinary Department on a kid which died in Ayer Itam Agricultural Station, Penang, revealed the cause of death to be Melioidosis; this herd has been placed in strict isolation and arrangements have been made with the Veterinary Department to examine and test all goats in Departmental herds to determine the extent of this disease.

Three stud bucks were distributed during the quarter.

New Villages.

It is reported from Penang that, while good crops of vegetables and large numbers of pigs are being produced in new villages, the facilities for marketing are far from satisfactory and producers are not getting fair returns for their efforts. In this Settlement the Department is assisting with three fencing schemes to protect crops from the depredations of wild pigs.

In Kelantan, the Agricultural Assistant recently posted to Ulu Kelantan to give help to new villagers, has achieved considerable success in encouraging vegetable and food crop planting; he has also organised wet padi demonstration plots, introduced budded fruit trees and promoted school gardens. A site for an agricultural extension station has been selected at Dabong. In conjunction with the Emergency Administrative Officer (Agriculture), enough clonal rubber seedlings have been raised in Ulu Kelantan nurseries to provide planting material for 1,000 acres of land in the New Villages Aided Rubber Planting Scheme.

In Trengganu, four extension vegetable manurial trials at the new village at Batu Lima, Dungun, on pak choy, long bean, radish and cabbage demonstrated considerable increases in yield.

Department of Agriculture tractors were hired out at Changkat Jong, Perak, to open up 200 acres of the new village agricultural land.

A Chinese Agricultural Assistant has joined the staff of the Department in Pahang and has been posted, in the first instance, to Temerloh to concentrate on new village agricultural problems round Triang, Bentong and Karak.

The State Agricultural Officer, Pahang, also reports:

"At Sungei Ruan, the new villages continued to work in co-operation with the Department in budding their rubber holdings. The work of the Chinese Rubber Instructor has been of particular value in this area. Pig breeding at the new village at Sungei Jan shows the influence of the Middle White boar issued by the Department, which has now sired 60 offspring".

Of his contribution to new village agriculture in the Settlement, the Settlement Agricultural Officer, Malacca, writes as follows:

"Financial assistance was provided to Parit Keliling new villagers to enable clearance of a stream and construction of small distributaries for the purpose of facilitating development of land for padi cultivation in the forthcoming season.

Clearance of overgrown drains (length 56 chains) in the Tanjong Minyak locality was commenced in June. There is a strong demand for land in the Ayer Salak valley, and it is estimated that clearance and re-digging of sections of old drains (now overgrown) in the area would be sufficient inducement for landless residents of Tanjong Minyak and Bukit Rambai new villages to open up, for food crop cultivation, more than 100 acres of land abandoned since the Japanese occupation of Malaya.

There remain a few landless families in the new village of Bukit Bruang, and Departmental staff have carried out a survey of available Crown Land situated relatively close to the village and have advised on development of sections considered to be suitable for food crop or padi cultivation.

Old rubber land acquired for alienation to cultivators in the new village at Tiang Dua in Central District has become a productive food crop area. At the end of the quarter, more than 60 acres were under cultivation. The soil is mainly a light friable loam, and popular crops grown are yam bean, sweet potato and ginger. Deep wells are required at this village to provide perennial water supply to pig sties, and financial assistance from Departmental funds was approved during the quarter for construction of a 3 ft. diameter concrete well in one of the main pig sty sections."

Group Settlements.

The following extract from a report of the State Agricultural Officer, Kedah, describes the proposed group planting of some 800 acres of rubber by hitherto shifting cultivators:

"In several of the inland districts, and especially in Padang Terap, there are many who lead a rather primitive existence on the basis of a small area of wet padi, and a larger area of shifting cultivation of dry padi, maize and tapioca. These areas are to be resettled, and it has been decided that the new villages shall, as far as possible, be so sited that the existing wet padi fields can be maintained and that an area is available for the planting of rubber. The object is to plant a "common field" with rubber co-operatively at the rate of three acres per family, and funds have been made available for the following new villages:

New Village	No. of Families
Bendang Bukit	45
Lampam	40
Padang Durian	85
Titi Akar	100

It was hoped that it would be possible to plant "common fields" this year, but this cannot be done as priority must clearly be given to the planting of padi and the construction of houses in the new villages. Meanwhile, two Junior Agricultural Assistants are being used to survey the soil in the areas and to plant a demonstration plot of one *relong* (.71 acre) in each "common field". The method that it is proposed to use in planting and maintaining the rubber blocks is that two or more Junior Agricultural Assistants will be made available to supervise the preparation and planting of the blocks, each family concerned providing one labourer every day for as long as necessary; for maintenance, a Junior Agricultural Assistant will visit on a definite day every week and each family will provide one labourer on that day. When the rubber is, say, 3 to 4 years old and well established, the block will be divided into holdings and allocated by lot to the families who have provided the labour previously. This gives an opportunity of settling permanently the shifting population which has done so much to ruin the soils of Padang Terap and other districts in Kedah."

Progress of Ex-Special Constables Settlement Schemes in Perak may be summarised as follows:-

At Bagan Bharu, 330 acres of land had been cleared by the end of June and the rubber clonal seedling nursery is progressing satisfactorily.

On the Changkat Panjang Scheme of 200 acres, clearing and burning was completed on 180 acres, of which 80 acres was sown with cover crops.

At Kampong Stia, clearing of *kampong* lots was completed during the quarter and vegetables were planted. No work has been done on the rubber lots, and the rubber nursery remains badly neglected in spite of repeated efforts to persuade the settlers to tend it properly.

The settlement at Sakai Jadi looks like being very successful if the settlers maintain their present standard of work; the rubber nursery is doing well.

In Selangor, the Kampong Traill settlement was handicapped by dry weather as regards the planting out of coffee seedlings, but these same weather conditions favoured clearing and burning of new land; full advantage was not, however, taken of the favourable conditions, and this may, in part, be blamed upon prevailing high prices for rubber which seduced settlers to more profitable paid employment in nearby rubber estates. In Selangor also, good progress was made at Sekinchang where a further 135,000 pineapple suckers were planted; the progress here since the end of last year is reported as being most encouraging. In the Kuang, Selangor, settlement, the whole area is now planted with banana, sugar cane and short term food crops; rambutan and durian seed have been sown at stake for future budding.

The Ulu Gali, Pahang, settlement is progressing well and 150 acres of land has been cleared for rubber. Initial clearing and house construction is in progress elsewhere in Pahang at the Paya Luas, Janda Baik and Paya Pelanta settlements.

After seeing the results of a demonstration of fruit tree manuring on their land, the settlers at Lubok Bandar, Johore, effected a considerable improvement in the condition of their fruit trees by the application of a complete fertiliser mixture. Agricultural work has not yet been started by the settlers at Batu Anam, Johore, although the land has been ploughed and allocated. At Kampong Mohd. Amin, also in Johore, demonstrations of laying out lots for intercultivation of rambutans with coffee were given, but progress is slow and of the 1,200 budded rambutans kept in reserve for the settlers, only 160 have so far been taken up and planted. About 100 shade trees have also been supplied to this settlement.

Agricultural Education.

Proposals for the construction of Rural Agricultural Training Centres in Kelantan, Malacca and Johore have been approved by the respective State and Settlement Governments, and in Johore a new design has been drawn up, to meet Health Office requirements, and tenders have been called for.

Courses held during the quarter at existing Training Centres were as follows:-

Gajah Mati, Kedah: two four-day refresher courses for staff of the Department and of the Rubber Replanting Board, embracing 29 persons, followed by five five-day courses on rubber replanting, given to a total of 63 men;

Kuala Kangsar, Perak: a one-week course on plant propagation to 49 *kampong* youths;

Cheras, Selangor: three courses on general agriculture to 41 youths;

Pekan, Pahang: two two-week courses on general agriculture to 32 youths, and a budding course, lasting one week, for 36 farmers at Kuala Lipis; and

Chembong, Negri Sembilan: one course on general agriculture lasting two months for aborigines, who proved enthusiastic and apt pupils. In addition, two 10-day courses on poultry management were given to applicants for loans from the Rural and Industrial Development Authority for poultry projects.

A total of 12 Civics Courses were held during the quarter, at which lectures and demonstrations on agricultural subjects were given. In Penang and Province Wellesley, talks, demonstrations and outings were arranged for four Young Farmers' Clubs.

In Johore, no less than 24 lectures were delivered on the principles of agriculture, rubber replanting, pig and poultry husbandry, land utilisation and padi, pineapple and fruit tree cultivation.

A staff refresher course for Agricultural Assistants from all States and Settlements was held at the College of Agriculture, Serdang, at which 20 officers attended for six days.

The 13th issue of the Kedah Quarterly Newsletter was published and distributed during the quarter, and leaflets on the separation of seed padi by floatation were distributed in Kelantan and Penang.

Agricultural Service Bureaux.

Mention has been made previously (Vol. XXXVIII, No. 1, 1955) of these Bureaux, which were started in Kelantan, and the following report by the State Agricultural Officer, Kelantan, is of particular interest:

"The working of these Bureaux has been reviewed during the quarter. They have been, and are, popular and valuable in Machang and Kota Bharu, but have not "taken on" elsewhere. There is little doubt but that the idea of officers being available at certain places where people congregate, at fixed times and on fixed days, is first class, and can pay very big dividends. This is particularly so when arrangements can be made to display the materials which the Department wishes to publicise and distribute on such occasions.

The reasons for lack of success in certain areas are quite simply that the officers concerned have been prevented, by the impact of other duties, from attending *regularly*, and that, because of inadequate transport arrangements, it has not always been possible to send planting etc. materials to the centres.

The ingredients for success appear to be 100 per cent *regular* attendance by staff, good "salesmanship" technique by staff, and the display and sale of improved materials combined with the giving of advice on farmers' problems.

Future policy will be directed towards consolidation of the position where success has been achieved, followed, in due course, by reintroduction of the idea in other Districts, when staff become available."

Economic Surveys.

The Agricultural Economist transferred his Headquarters to Sungei Patani, Kedah, on the 15th May in order to conduct an economic survey of padi planters in Perlis, Kedah and Province Wellesley. Field Recorders have been recruited and trained and field work started at the end of the quarter.

Preliminary work on initiating a similar survey in Kelantan has also started.

Reviews.

FLAYING AND CURING OF HIDES AND SKINS AS A RURAL INDUSTRY

F. A. O. Development Paper No. 49, Rome 1955. Pp. 136. Price seven shillings and sixpence.

This is a thorough and well produced treatise and one which presents in a concise form the processes and correct methods of flaying and curing essential for the production of good quality leather. Although it is stated that slaughterhouse production is only lightly touched upon, the reader in Malaya will find that the processes described are largely those practised in urban slaughterhouses. The subject matter can thus readily be related to the task of raising the local standard of hides and skins, whether produced in town or rural areas.

There are chapters on the production of hides, production of skins, curing of hides and skins, damage and defects, grading, folding and baling, hide trade equipment and its use, and on a proposed development scheme. In the chapters on production, the authors deal with killing, bleeding, flaying, washing, 'after-cleaning' and trimming in a manner easy to follow. The methods of curing hides and skins in Malaya follow those recommended under the sections on air-drying, salt-curing and pickling, but the reader will find those sections useful aids in assessing the standard of local techniques and in advising on methods suitable for particular conditions. Ground drying has been rightly condemned.

A comprehensive list of damages and defects, both ante- and post-mortem, is dealt with, and suggestions are made for reducing the losses caused by the various factors involved.

The development of the hide and skin industry in Malaya has been limited to some extent by the relatively low value of the total production, which is estimated at $500,000 per annum. Nevertheless, the standard of production is reasonably high, and there is a ready market both locally and abroad. The trade is seemingly well organised. A number of tanneries are operating in different parts of the country, and exporters adopt a system of grading which, although not officially administered, is presumably satisfactory, if the fact that hides and skins are exported to some 15 countries is any criterion. The section on a proposed development scheme, in which a Hides and Skins Improvement Programme is suggested, is nevertheless worthy of careful consideration by officials connected with rural development and by those engaged in the trade.

The suggestion that a local committee on hides, skins and leather be established is also a commendable one as it would enable Government officers and representatives of merchants and tanners to discuss the necessity for a development scheme and to act in an advisory capacity to those technical officers in a position to develop the industry.

The publication should be in the possession of all veterinary officers, abattoir superintendents, meat inspectors, and Development Officers; it is also commended to those engaged in the trade of curing, tanning and exporting hides and skins.

The publication contains many illustrations which greatly add to its value for demonstration purposes.

The binding of the publication might with advantage have been more secure, as even with limited handling there is a tendency for the pages to come loose.

C.C.R.

THE USE OF TOWNS' WASTES IN AGRICULTURE

A study by the Natural Resources (Technical) Committee. Office of the Lord President of the Council. H.M.S.O., London, 1954. Pp. iv + 25 with Tables 6. Price one shilling and threepence.

In all densely populated areas the problem of safe and economic utilisation of waste organic materials of human, animal and plant origin is of direct concern to the agriculturist. Most of these materials are of some value to the land through their favourable effects on the physical structure or nutrient status of the soil.

The criteria that any scheme for the processing of waste materials has to satisfy are those of hygiene and economics. Hitherto, the many compost making and night-soil processing schemes undertaken in Malaya have proved uneconomic when carried out under conditions that precluded fly-breeding and which also ensured an end-product free of live internal parasite ova. Further, much of the so-called safe compost has been shown to have a manurial value little above that of good garden soil.

Against this background of Malayan experience it is interesting therefore to read this report of the Natural Resources (Technical) Committee concerning the possible value to agriculture of the waste products of towns in the United Kingdom.

After compressing a great deal of information into only 25 pages, the Committee expresses the conclusion that apart from dried digested sludge and activated sludge the potentialities of town wastes in agriculture have often been over-estimated and their further processing generally uneconomic. Stress is laid, however, on the value of bulky organic matter in horticulture and the usefulness of minor-scale developments in the preparation of composts of sewage sludge and agricultural wastes by local authorities in collaboration with farmers.

Such schemes as there are in Malaya exist largely for the benefit of market gardeners and are usually on a small scale. The inference that may be drawn from this report is that as the development and urbanisation of Malaya proceeds, the large-scale treatment of waste organic materials for the benefit of agriculture is unlikely to be worthwhile.

M.S.

Departmental Notes.

Retirements.

Mr. R. B. Jagoe.

With the departure, on the 11th July, 1955, of Mr. R. B. Jagoe, Chief Research Officer, on leave prior to retirement, the Department has lost not only one of its most active and enthusiastic members but also one of the very few remaining links with the distant days of the 1920's.

Robert Browning Jagoe joined the Department as an Agricultural Field Officer in September, 1926, and after 13 months service in the State of Selangor, was appointed Assistant Economic Botanist in October, 1927. He remained with the Botany Division for the next 24 years, being in charge of it, first as Botanist and later as Senior Botanist, for most of the period. Although during the three years from 1934 to 1937 the Division was in abeyance owing to economic depression and retrenchment of staff, Jagoe succeeded in maintaining interest and preserving results until work could be more actively resumed. From what had shrunk to a one man show in the years preceding the war, by the time of his retirement he had built up the Botany Division to be the largest, and consequently most active one, in the Research Branch.

Appointed to act as Chief Research Officer in October, 1951, he was confirmed in the appointment in October, 1952, and continued to occupy the office until his retirement.

From his first arrival in the country he was an enthusiastic member of the F.M.S. Volunteer Forces, served with the armed forces during the Pacific War and was a prisoner-of-war in Siam for several years. He returned to Malaya after convalescence in England and rejoined the Department in December, 1946.

A biologist with unusually wide interests, there were few aspects of the work of the Department in which he did not interest himself at one time or another. As a keen gardener and student of natural history, his knowledge of the pure and applied botany of Malaya covered a wide field and his services in an advisory capacity were actively sought.

His work in the Department was chiefly related to varietal improvement of padi and oil palm, and the majority of the many articles which appeared under his name in this Journal between 1929 and 1954 are devoted to these two crops. Perhaps his most notable achievement in this field was the discovery and development of the "Dumpy" variety of oil palm on which our present breeding programme with this crop is primarily centred. To him too the Department owes the foundations on which breeding work with coconuts, food and other crops is now being developed. His work on the ecology of pasture grasses, weed killers and rice storage are a further valuable contribution.

Latterly he was preoccupied with the administrative aspects of research, and the best testament to his activities as Chief Research Officer is the active, well organised and harmonious Research Branch he has left behind him.

Most remarkable perhaps for his unquenchable energy and the individuality of his approach, no one could have desired a more stimulating, if at times unpredictable colleague to work with. We expect of him an active retirement and we wish him and his wife prolonged health and happiness in whatever sphere his energies may direct them.

L.N.H.L.

Enche Mohamed Rashid bin Ahmad.

Enche Mohamed Rashid, Assistant Lecturer, College of Agriculture, retired from Government Service on the 15th June, 1955. He was a student at the College (then School) of Agriculture from 1935 until 1937 when he gained his Diploma. His first appointment was as Agricultural Assistant, Pekan, from 1937 to 1946, where he quickly won the confidence and trust of the people in Pahang. In 1946, he was posted to the College of Agriculture, first as Agricultural Assistant and then as Assistant Agricultural Officer (Assistant Lecturer), in which post he remained until his retirement. During his tenure of office at the College, Che Mohamed Rashid was awarded a scholarship of 10 months duration under the Colombo Plan to New Zealand and Australia in order to study methods of agriculture, agricultural education, extension services, and rural youth work. In 1953, he gained a British Council Visitorship to the United Kingdom and again visited chiefly places of agricultural interest, and later in the same year was selected as a delegate for the Federation of Malaya and Singapore to attend the International Conference of Rural Youths in Rome.

Enche Mohamed Rashid has also engaged in numerous voluntary activities, e.g. as Member of Federal Rural and Industrial Development Authority, and R.I.D.A. Training Committee, as Member of Executive Committee and National Council of the Adult Education Association, as President of the Parent Teachers Association, as Secretary of the Alumni Association of the College, as a broadcaster on agriculture (Malay Section), Radio Malaya, and as President of the Malayan Agricultural Union. He was also a Member of the Federal Legislative Council, of the Standing Committee on Finance, and of the Rice Committee. He has retired from Government Service in order to devote all his time and energies to political activities, and is a Member of the Council Group and National Council of Party Negara.

Enche Rashid is a dynamic personality and a born teacher. By his enthusiasm and keen interest in all aspects of agriculture, and by inspiring leadership, he has done excellent service in the training of young agriculturists in Malaya. We greatly miss him at the College, but we all join together in wishing him every success in his new career.

O.M.L.

Tuan Haji Abdul Rahman bin Mahmood, P.I.S.

Tuan Haji Abdul Rahman, Agricultural Assistant, Special Grade, retired from the Service with effect from the 11th June, 1955.

Tuan Haji Abdul Rahman was first appointed to the Department in 1921 as an Agricultural Apprentice, and after a period of initial training in Kuala Lumpur was appointed Agricultural Assistant, serving in various Districts in Johore until the outbreak of war. During the Japanese Occupation of Malaya he was in charge of the Department of Agriculture in Johore. Immediately after the war he was in charge of Johore South Circle, but after a short period of deteriorating health he was medically boarded out of the Service, and retired with effect from the 16th January, 1948. He did not remain long in retirement, and the Department was very fortunate in regaining his services in August, 1948, at a time when there was an acute shortage of staff. He was posted to Muar as Agricultural Assistant, and on the 1st January, 1949, was promoted to Agricultural Assistant, Special Grade. He was in charge of the Johore North Circle from June, 1951, until his retirement.

Tuan Haji Abdul Rahman was an officer who commanded the respect of all those with whom he served, and in September, 1952, he was awarded the *Pingat Yang Maha Mulia Ibrahim Sultan*, a distinction and honour well earned by the work he had carried out with conspicuous success in Johore for many years. He was a staunch supporter of the smallholder, and for some time was President of the Johore Smallholders' Association, and a representative on the Rubber Producers' Council. He will be much missed by the Department in Johore, and on his retirement carries with him the good wishes of the Department for his continued health and happiness.

H.K.A.

Enche Mohamed Sulong bin Mohd. Ali.

Enche Mohd. Sulong bin Mohd. Ali, Agricultural Assistant, retired from Government service on the 15th June, 1955, in order to contest the Federal and State Elections.

Che' Sulong joined the Department of Agriculture in 1926 and remained for the whole of his service in Pahang. At one time or another during the past 29 years he was stationed in all the districts of the State, with the exception of Cameron Highlands. He thus acquired a considerable knowledge of the State as a whole and, in particular, of those remote *kampongs* that can only be reached by arduous travelling on foot and by boat.

In taking the courageous decision to exchange the comparative peace of Government service for the battlefield of politics, Che' Sulong carries with him the best wishes of his former colleagues in the Department of Agriculture.

H.M.J.

Appointments.

Mr. R. G. Heath, Deputy Director of Agriculture, was appointed Director of Agriculture, Federation of Malaya, with effect from the 23rd June, 1955.

Mr. A. R. McWalter, Chemist (Soils), was appointed to act as Senior Chemist (Soils) with effect from the 1st July, 1955.

Mr. L. N. H. Larter, Senior Botanist, was appointed to act as Chief Research Officer with effect from the 12th July, 1955.

Mr. F. B. Brown, Botanist, was appointed to act as Senior Botanist with effect from the 12th July, 1955.

Transfer.

Che. Mohamad bin Jamil, Agricultural Officer, was transferred to the post of Agricultural Officer, Perak South, on the 29th July, 1955.

Leave.

Mr. J. A. Cox, Agricultural Development Officer, returned from leave on the 7th May, 1955.

The following officers have proceeded on leave:-

Mr. J. K. Coulter, Chemist (Soils) on the 2nd July, 1955.

Mr. T. R. Dickinson, Agricultural Officer, on the 29th July, 1955.

Cessation of Contract.

Dr. W. F. Grant, who has been on contract to the Canadian Government to serve in Malaya under the Colombo Plan as a Plant Breeder, left Malaya on the 31st July, 1955, to return to Canada on completion of his contract.

Statistical.

MARKET PRICES

April to June, 1955.

Rubber.—The period under review saw the Singapore price of R.S.S. No. 1 (f.o.b. in bales, buyer) rise from 87 cents per lb. on the 4th April to 116.50 cents on the 28th June, the highest price since February, 1952.

In April, the price was fairly steady, with a maximum of 91.75 and a minimum of 87 cents per lb. The average price for April was 89.71 cents.

Again in May, although the price reached 93.375 cents on the 26th there were no signs of the higher prices that were to come later in the quarter. On the 1st May, the price was 90.125 cents, and on the 31st it was 92.625. The average for the month was 91.02 cents per lb.

The price did not pass the $1 level until the 10th June, when it was 100.875 cents; it was at 108.25 cents on the 24th and jumped to 114.25 cents the next day. The highest price reached in June was 116.50 cents per lb. and the average for the month was 105.26 cents.

The prices given above are the noon prices for rubber as reported by the Singapore Chamber of Commerce and they have been taken from the Monthly Statistical Bulletin of the Federation of Malaya.

The average prices paid during the quarter for smallholders' rubber at three towns in the Federation are shown in Table I.

Table I.

Average Monthly Prices Paid by Local Dealers for Smallholders' Rubber, April to June, 1955.

(Dollars per picul of 133 1/3 lbs.)

Grades.	Taiping, Perak.			Seremban, Negri Sembilan.			Batu Pahat, Johore.		
	April	May	June	April	May	June	April	May	June
Smoked Sheet No. 1 ..	97.62	99.62	114.41	98.32	100.09	113.68	98.07	99.28	111.59
Unsmoked Sheet ..	81.60	84.47	95.04	77.08	78.58	86.26	85.44	86.13	93.77
Scrap ..	49.13	45.66	56.50	53.49	55.19	61.18	36.52	37.85	41.12

This Table has been compiled from statistics supplied by the Registrar of Statistics, Federation of Malaya.

Tea.—The Registrar of Statistics, Federation of Malaya, reports that 789,999 lb. of black tea, valued at $1,626,750, was exported during the period under review. Production figures for the period are not available, but in the previous quarter 1,268,530 lb. made tea was produced.

The average prices paid for Ceylon teas at the public auction in Colombo on the 28th June, 1955, as reported in the Weekly Tea Market Report of the Colombo Brokers' Association, were as follows, in rupees per lb:- High Grown Teas (4,000 ft. and above) 2.03, Medium Grown Teas (2,000 to 3,999 ft.) 1.78, and Low Grown Teas (below 2,000 ft.) 2.36.

Palm Oil.—The London prices for this commodity were, in Malayan dollars per ton:- April 657.85, May 649.28, and June 615.00. The average price paid in London during the first quarter of 1955 for oil shipped by the Malayan Oil Palm Pool, f.o.b. ex-installation, Malaya, was $644.21 per ton.

Derris.—The price of derris has remained at $110 per picul.

Table II.

Singapore Prices of Various Agricultural Products.

(Dollars per picul)

Date	Copra, Sundried	Coconut oil*	Pepper, F.A.Q. Muntok white	Pepper, Gen. Muntok white	Gambier, Cube, No. 2	Sago Flour, Lingga	Tapioca Flour No. 1	Oilcake, Round
1955								
4th April ..	28.75	44.00	191.00	201.00	42.00	12.87½†	16.00	14.50
12th April ..	28.50	44.50	180.00	190.00	48.00†	12.87½	16.50	14.25
18th April ..	27.25	44.00	182.00	192.00	48.00†	12.87½	16.25	15.00
25th April ..	28.00	43.50	175.00	185.00	48.00†	12.87½	16.25	15.50
2nd May ..	27.25	43.75	180.00	190.00	48.00†	12.87½	17.00	15.00
9th May ..	26.25	42.50	178.00	188.00	48.00	12.75	17.00	15.50
16th May ..	26.25	42.00	177.00	187.00	48.00	12.75	17.25	14.50
24th May ..	27.00	43.50	180.00	190.00	48.00	12.75	17.50	15.00
31st May ..	28.00	43.50	178.50	188.50	46.00	12.75	17.50	15.00
6th June ..	28.50	45.00	187.50	197.50	46.00	12.87½	17.50	15.00
13th June ..	28.50	44.00	182.00	192.00	46.00	12.87½	17.50	15.00
20th June ..	28.25	42.25	179.00	189.00	42.00	12.75	17.50	15.00
27th June ..	27.25	44.00	177.00	187.00	46.00	12.75	17.25	15.50

* F.O.B. in drums.

† Nominal.

The above prices are taken from the weekly reports of the Singapore Chamber of Commerce.

FEDERATION OF MALAYA
PRODUCTION OF PALM OIL AND KERNELS.

(In long tons as declared by Estates)

Month	Palm Oil		Palm Kernels	
	1954	1955	1954	1955
January ..	4,143	4,093	1,139	1,124
February ..	3,908	3,997	1,066	1,081
March ..	4,442	4,854	1,210	1,300
April ..	4,674	4,630	1,228	1,221
May ..	5,251	4,152	1,396	1,076
June ..	4,188	5,135	1,114	1,256
July ..	4,580		1,162	
August ..	4,694		1,236	
September ..	4,319		1,157	
October ..	4,333		1,154	
November ..	4,642		1,273	
December ..	4,776		1,336	
Total ..	53,950	(26,861)	14,471	(7,058)

In June, 54 estates were in production out of a total of 61 oil palm estates.

MALAYAN AGRICULTURAL EXPORTS, JANUARY—MARCH, 1955.

Product	Net Exports in Tons.			
	Year 1953	Year 1954	Jan.-Mar., 1954	Jan.-Mar., 1955
Arecanuts	11,580	5,511	1,879	5,192
Coconuts, fresh † ‡ ..	88,315 †	94,433 †	19,650 †	21,084 †
Coconut oil ‡	60,779	78,507	19,145	21,571
Copra ‡	9,751 *	67,472 *	11,108 *	19,964 *
Copra cake	59,129 *	40,520 *	14,594 *	10,112 *
Gambier, all kinds ..	160 *	134 *	63 *	92
Palm Oil	47,579	48,908	11,597	12,678
Pineapples, canned ..	17,368	21,533	4,660	6,631
Rubber¶	572,792 ¶	582,991 ¶	134,567 ¶	158,057 ¶
Sago,—flour	28,444	27,980	7,038	5,776
Sago,—pearl	5,896	5,122	1,238	1,909
Sago,—raw	27,246 *	27,021 *	9,101 *	4,772 *
Tapioca,—flake	128 *	49	236 *	36
Tapioca,—flour	7,362 *	4,555 *	1,928 *	1,167 *
Tapioca,—pearl	5,474	7,865	1,626	1,404
Derris	10	16	3	2
‡ Copra equivalent ..	90,781	88,943	20,396	15,511

¶ production (Federation of Malaya). † hundreds in number. * net imports.

FEDERATION OF MALAYA RUBBER PRODUCTION.

(In long tons, dry weight)

Month	Estates		Smallholdings (Estimated)		Total	
	1954	1955	1954	1955	1954	1955
January ..	30,278	29,260	19,014	26,033	49,292	55,293
February ..	25,354	28,497	17,913	21,928	43,267	50,425
March ..	24,556	27,465	17,452	24,874	42,008	52,339
April ..	24,749	24,155	15,339	20,415	40,088	44,570
May ..	27,572	27,355	18,585	22,331	46,157	49,686
June ..	26,873	27,497	16,236	22,841	43,109	50,338
July ..	30,970		22,931		53,901	
August ..	30,826		21,576		52,402	
September ..	30,067		23,371		53,438	
October ..	29,405		20,724		50,129	
November ..	31,798		22,925		54,723	
December ..	30,313		24,164		54,477	
Total ..	342,761	(164,229)	240,230	(138,422)	582,991	(302,651)
Total 1953 ..	341,117		231,675		572,792	

This Table has been compiled from statistics published by the Registrar of Statistics, Federation of Malaya.

Production on smallholdings (estates of less than 100 acres) is taken as the total of purchases from smallholders reported by licensed dealers.

FEDERATION OF MALAYA

PRODUCTION OF COPRA, COCONUT OIL AND COPRA CAKE.

(in tons)

Month	Copra Production						Coconut Oil Production		Copra Cake (Poonac) Manufactured	
	Estates (a)		Smallholdings (estimated)		Total		Oil Mills		Oil Mills	
	1954	1955	1954	1955	1954	1955	1954	1955	1954	1955
January ..	3,123	2,674	9,470	4,297	12,593	6,971	8,837	5,528	5,583	3,561
February ..	2,789	2,797	9,616	8,366	12,405	11,163	7,798	7,753	4,891	4,808
March ..	3,072	2,975	11,482	7,726	14,554	10,701	8,721	7,368	5,487	4,603
April ..	2,993	3,021	9,922	7,478	12,915	10,499	6,961	6,165	4,515	3,934
May ..	3,803	3,619	10,128	7,630	13,931	11,249	8,098	7,399	5,195	4,580
June ..	3,763	3,748	12,175	10,534	15,938	14,282	8,158	8,017	5,181	5,128
July ..	4,112		11,850		15,962		8,582		5,505	
August ..	3,886		11,237		15,123		8,480		5,489	
September ..	3,481		10,631		14,112		8,501		5,403	
October ..	3,069		11,160		14,229		8,014		5,184	
November ..	2,942		8,854		11,796		7,296		4,602	
December ..	2,831		7,770		10,601		7,354		4,533	
Total ..	39,864	(18,834)	124,295	(46,031)	164,159	(64,865)	96,800	(42,230)	61,568	(26,614)

Notes:—1. The above Table has been compiled from statistics published by the Registrar of Statistics, Federation of Malaya.

2. Estate copra production and coconut oil production are as declared by estates and oil mills respectively.

3. Statistics of smallholding coconut oil production are not available.

4. Smallholding copra production for commercial purposes is estimated from the formula: imports + estate stocks (opening) + estate production + smallholding production = exports + local oil mill consumption + estate stocks (closing).

(a) Includes copra equivalent of sales of fresh nuts by estates.

METEOROLOGICAL SUMMARY, MALAYA, MARCH, 1955.

Locality	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall									Bright Sunshine		
	Means of			Absolute Extremes									Number of days								
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total		Most in a day Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										in	mm.	in						hr.	hr.	
Ipoh, Perak ..	94.7	72.1	83.4	98.3	69.1	89.6	74.4			4.96	126.0	1.98	11	7	4		1	239.05	7.71	
Kuala Lumpur, Selangor	91.0	73.2	82.1	94.3	70.4	85.3	75.4			14.04	356.6	2.78	18	16	11	7				
Sitiawan, Perak ..	90.7	72.3	81.5	94.7	70.0	85.7	75.6	84.9	85.4	2.22	56.4	0.43	14	8	9			227.90	7.35	
Kuantan, Pahang ..	88.9	69.9	79.4	92.4	66.6	82.6	73.9	83.1		2.18	55.4	0.97	6	4		3		232.45	7.50	
Bayan Lepas, Penang ..	90.2	74.5	82.3	93.0	71.9	84.3	77.2			4.57	116.1	1.15	13	11	6			247.60	7.99	
Malacca ..	90.7	73.7	82.2	94.2	71.8	86.7	75.3			7.19	182.6	2.25	15	12	5			244.55	7.89	
Mersing, Johore ..	86.0	73.3	79.7	88.3	70.5	80.0	78.6			1.91	48.5	1.07	8	2				253.55	8.18	
Alor Star, Kedah ..	95.5	71.6	83.5	99.0	68.0	91.2	75.0			1.63	41.4	0.68	4	4	2			290.05	9.36	
Kota Bharu, Kelantan ..	88.4	72.0	80.2	90.2	65.8	86.9	78.5	87.6	86.3	0.44	11.2	0.41	2	1		1		292.30	9.43	
K. Trengganu, Trengganu	87.3	71.8	79.5	88.9	66.6	84.0	76.2			0.41	10.4	0.26	4	3		2		281.60	9.08	
Singapore ..	89.3	74.7	82.0	92.4	71.4	84.3	76.2			1.90	48.3	0.66	11	10	3			206.35	6.66	
HILL STATION.																				
Cameron Highlands, Tanah Rata, Pahang. (4750 ft.)	74.5	53.7	64.1	77.0	46.0	70.0	61.0			5.12	130.0	1.55	8	8				199.40	6.43	

Compiled from Returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, APRIL, 1955.

Locality	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall									Bright Sunshine		
	Means of			Absolute Extremes								Most in a day	Number of days								
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total			Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										in	mm.	in						hr.	hr.	
Ipoh, Perak ..	92.2	73.3	82.7	94.5	70.8	89.0	76.0			7.33	186.2	1.46	17	14	4			207.80	6.93	
Kuala Lumpur, Selangor	89.6	73.5	81.5	92.1	71.2	83.0	75.6			12.13	308.1	1.62	22	20	12	10				
Sitiawan, Perak ..	89.5	72.8	81.1	93.0	70.3	85.2	75.9	84.7	85.7	7.85	199.4	1.82	15	12	8			211.25	7.04	
Kuantan, Pahang ..	90.1	72.3	81.2	95.2	69.3	85.7	74.8	84.3		2.70	68.6	0.70	14	12	4	3		200.80	6.69	
Bayan Lepas, Penang ..	87.9	74.3	81.1	90.0	72.2	83.0	76.3			6.36	161.5	1.48	17	14	8			225.80	7.53	
Malacca ..	88.3	73.2	80.7	91.6	71.4	83.3	74.9			12.64	321.1	1.78	18	11	4	1		185.95	6.20	
Mersing, Johore ..	87.4	72.5	79.9	90.0	70.6	77.6	74.4			3.20	81.3	1.08	13	10				228.30	7.61	
Alor Star, Kedah ..	92.3	73.2	82.7	96.0	70.9	85.3	75.6			7.96	202.2	1.58	19	13	5	2		242.10	8.07	
Kota Bharu, Kelantan ..	88.7	74.1	81.4	91.9	71.9	82.6	76.0	88.6	88.1	3.41	86.6	0.95	12	12	4			242.50	8.08	
K. Trengganu, Trengganu	88.1	72.8	80.5	90.5	70.8	82.0	74.6			7.81	198.4	2.55	12	12	1			238.25	7.94	
Singapore ..	88.5	75.7	82.1	92.4	72.5	82.2	80.9			7.40	188.0	3.00	16	12	8		1	185.95	6.20	
HILL STATION.																				
Cameron Highlands, Tanah Rata, Pahang. (4750 ft.)	73.6	56.6	65.1	79.0	51.0	68.0	62.0			13.10	332.7	2.55	22	22				139.60	4.65	

Compiled from Returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, MAY, 1955.

Locality	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall									Bright Sunshine		
	Means of			Absolute Extremes									Number of days								
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total		Most in a day	Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more		Total	Daily Mean	Per cent.
												Amt.									
										in	mm.	in							hr.	hr.	
Ipoh, Perak ..	92.7	73.7	83.2	96.2	68.7	86.4	76.3			5.27	133.9	1.48	15	15	3	1			228.80	7.38	
Kuala Lumpur, Selangor	91.4	73.9	71.3	94.8	69.5	80.6	76.2			1.83	46.5	0.55	7	6	4	8					
Sitiawan, Perak ..	90.4	73.5	81.9	94.3	68.0	85.0	76.0	85.4	86.0	1.90	48.3	0.86	10	8	4				216.95	7.00	
Kuantan, Pahang ..	91.4	73.1	82.3	94.5	69.2	88.5	76.8	84.3		7.05	179.1	1.62	15	15	9	3			228.35	7.37	
Bayan Lepas, Penang ..	88.6	74.8	81.7	92.6	71.5	85.0	77.1			11.64	295.7	3.23	17	14	7				201.70	6.51	
Malacca ..	90.2	73.5	81.9	93.7	68.3	82.1	76.9			1.53	38.9	0.62	7	6		1			246.20	7.94	
Mersing, Johore ..	90.3	72.6	81.5	95.2	67.8	85.3	74.8			2.02	51.3	0.70	14	8	1				239.05	7.71	
Alor Star, Kedah ..	89.4	75.1	82.3	94.2	72.1	84.1	77.6			7.36	186.9	2.10	18	13	3				197.35	6.37	
Kota Bharu, Kelantan ..	89.9	75.4	82.7	92.5	72.3	87.0	78.1	88.4	88.4	2.32	58.9	0.68	12	8	4	1			232.85	7.51	
K. Trengganu, Trengganu	89.6	74.0	81.8	91.8	71.7	86.9	76.0			0.77	19.6	0.14	11	9	1				255.80	8.25	
Singapore ..	89.5	76.5	83.0	93.1	72.7	84.9	81.6			5.08	129.0	1.35	10	9	5		1		214.45	6.92	
HILL STATION.																					
Cameron Highlands, Tanah Rata, Pahang. (4750 ft.)	74.8	56.8	65.8	79.0	47.0	71.0	63.0			8.06	204.7	1.20	18	16					179.35	5.79	

Compiled from Returns supplied by the Malayan Meteorological Service.